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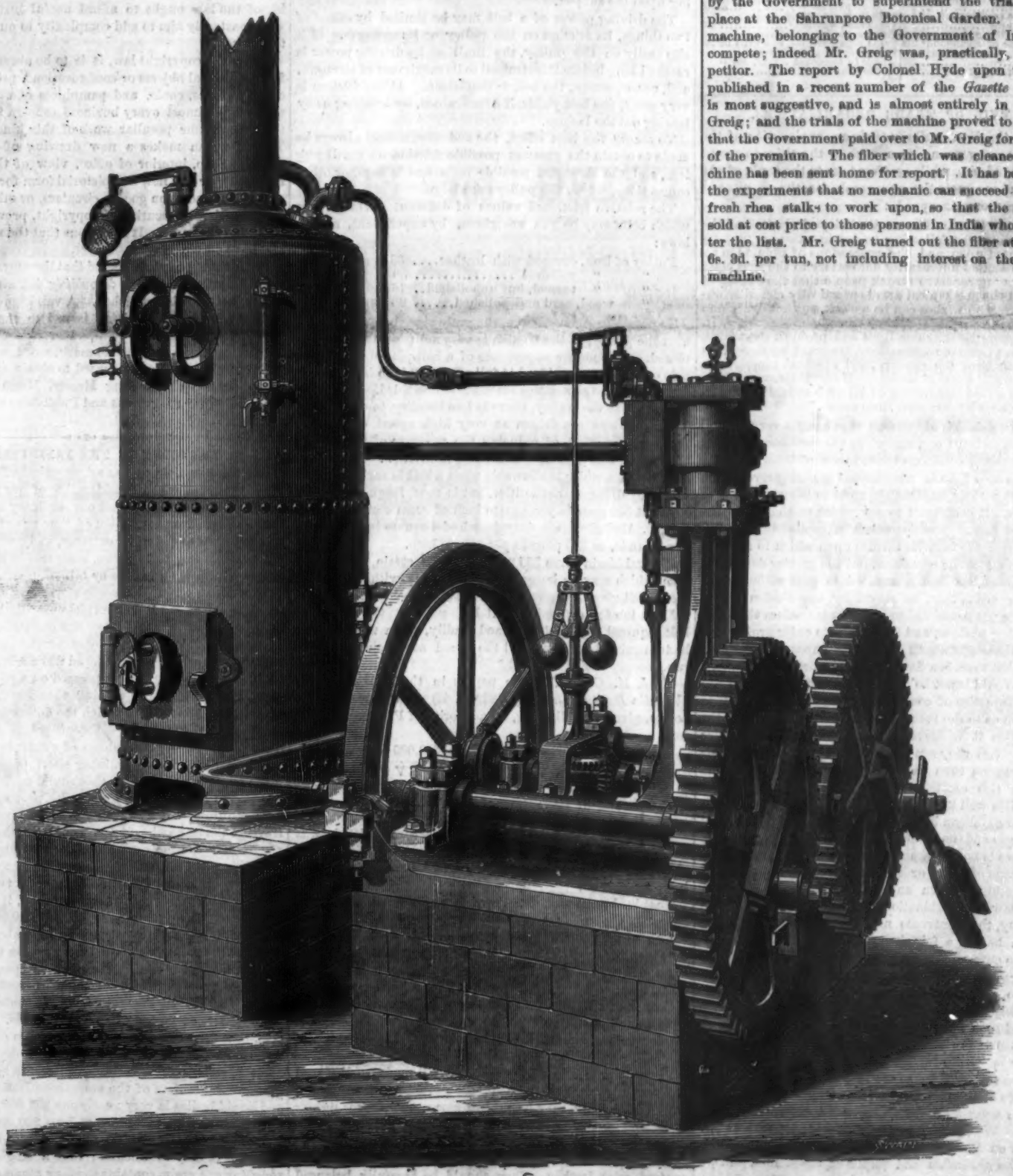
STEAM PUMPING ENGINES FOR INDIA STATE RAILWAYS.

We herewith illustrate one of the pumping engines just completed by Messrs. Hathorn, Davis & Campbell, of the Sun foundery, Leeds, England, for India State railways. These engines, says the *Engineer*, from which our engraving is taken, are of the vertical type, with six inch cylinders and eight inch stroke; the pumps are worked by means of a spur pinion on the crank shaft, and spur wheels on the countershafts; the pump rods are fixed to the spur wheels in such a way that the stroke of the pumps can be lengthened or shortened at pleasure. The engines run at 165 revolutions per minute, and the pumps at thirty revolutions. The pumps, two in number, are double acting, five and one quarter inches diameter by ten inches stroke, lined with brass, and are capable of delivering collectively, eighty gallons of water per minute, thirty feet high. The valves are arranged so that they can be got at without disturbing either suction or delivery pipes.

The engine and boiler are fixed upon a stone foundation at the top of the well, and the pump on a wood beam fixed a little above the water level. The boiler is of the vertical type, five feet eleven inches high by two feet six inches diameter, with internal fire box, having two cross tubes. All the plates are three eighths inch thick, of best Staffordshire iron, except the fire box, which is of Farnley iron. The workmanship and material are alike excellent, and well maintain the reputation of the firm.



STEAM PUMPING ENGINE FOR INDIA STATE RAILWAYS.

Paint on Wrought Iron Plates.

This matter has been carefully investigated under the auspices of the Dutch State Railways, and the result was brought before the Society of Dutch Engineers by Van Diesen. Of thirty-two plates, half the number were plunged in diluted hydrochloric acid for twenty-four hours, then neutralized with lime (slaked), rinsed in hot water and, while warm, rubbed with oil; the other half were mechanically cleaned by means of scraping and brushing. Four plates of each kind were then prepared with one coat of red lead, two sorts of oxide of iron, and coal tar. This was done at Harkort's works in July, 1867. The plates were then exposed to the influence of the weather for a period of three years and re-examined, when it was found: 1. That the coating of red lead had stood well on plates of either method of preparation, therefore in this case no preference could be assigned. 2. That oxide of iron, by Kampand Soeten, gave better results on plates cleaned chemically than on those cleaned mechanically, the coat on the former being in as good a state of preservation as the red lead. 3. That oxide of iron by Anderghem gives as good results on plates cleaned chemically as the two previous materials, but is inferior to them if applied to scrubbed surfaces. 4. That coal tar is much inferior to any of the preceding; from scrubbed surfaces it had almost entirely disappeared.—*Iron.*

Award to an Edinburgh Engineer.

The late Lord Mayo, while Governor General of India, offered a reward of £10,000 for a machine to clean and prepare the valuable rhea fiber for the market. Mr. Greig, engineer, Edinburgh, invented and patented an ingenious machine for that purpose, and about a year ago he proceeded to India in order to compete for the valuable prize. No other competitors worthy of the name appeared at the trials. Colonel Hyde, the Master of the Mint of India, was appointed by the Government to superintend the trials which took place at the Sahrunpore Botonical Garden. An American machine, belonging to the Government of India, did not compete; indeed Mr. Greig was, practically, the only competitor. The report by Colonel Hyde upon the trial was published in a recent number of the *Gazette of India*. It is most suggestive, and is almost entirely in favor of Mr. Greig; and the trials of the machine proved to be so hopeful that the Government paid over to Mr. Greig forthwith £1,500 of the premium. The fiber which was cleaned by the machine has been sent home for report. It has been proved by the experiments that no mechanic can succeed unless he has fresh rhea stalks to work upon, so that the fiber is to be sold at cost price to those persons in India who desire to enter the lists. Mr. Greig turned out the fiber at a cost of £18 6s. 3d. per tun, not including interest on the cost of the machine.

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THE EVIL OF TRADE ORGANIZATIONS.

We find in the Boston *Daily Globe* an explanation of the reason why so many young men rush to the cities to accept the position of clerks, while so few take to the trade of the mechanic; and we quote the paragraph for the purpose of founding a few remarks upon it:

"ONE REASON WHY.—The multiplicity of clerks and the scarcity of young men following trades in cities are matters often commented upon, and the expressions of opinion in regard to it are almost universally derogatory to the first class named. It may never have struck people that the school of instruction in the mechanical arts is practically closed nowadays. Any one who wishes can be a clerk, but not every one can be a mechanic, no matter how earnestly he may desire it. The trade organizations, which limit and prohibit the taking of apprentices to various occupations, are cruel combinations against the youths of the country, and criminal conspiracies against the best interests of society. Under their sway, there is growing up a vast community of idlers, hundreds of whom are driven, almost by necessity, into crime."

There are two classes of persons who exert a very baleful influence upon society; one comprises the capitalists who by combinations seek to close up the avenues of labor, and the other is made up of trade associations which prevent men from exercising their inalienable right to labor where they can find work. It is difficult to say which of the two is the more reprehensible. The despotism of capital and the tyranny of the rich are favorite themes upon which to ring the changes upon all public occasions; but the greater despotism of trades' unions has been permitted to pass without comment. The result is that, as stated by the Boston *Globe*, many men are not permitted to learn trades unless they will make degrading pledges, and they prefer to enter professions where such distasteful conditions are not imposed. The consequence is that there is a dearth of mechanics and a *plethora* of clerks. Would it not be well for mechanics to reflect upon the great injustice of compelling everybody to submit to their dictation as to the manner of learning a trade and the right to practice it wherever and whenever the apprentice may please? Are they not really exerting a greater despotism and oppression than they ever have to endure at the hands of the rich capitalists of whom they so frequently complain? It is well known that in the United States, which boasts of its republican institutions, there are certain trades which no negro and no woman would be permitted to learn. It is true there is no statute law prohibiting any person of whatever shade of color or sex from taking out indentures of apprenticeship to learn anything they please; but there is a higher law of combinations, which is enforced with cruel certainty, that prevents not only the blacks and the women from having a fair chance in the struggle for existence, but also cuts off many a white man from following the bent of his genius. This goes to prove that it is always dangerous to play the part of an oppressor. The moment we become despotic in one thing we acquire a dangerous love of power and soon carry the thing to excess. The right of everybody to strive to become rich by honest, intelligent and patient labor is wholly inalienable, and it was to establish this right and the freedom to worship God according to the dictates of his own conscience that the Puritan first planted his foot upon American soil and laid the foundation of a future empire. We recall a few eloquent words spoken by Mr. Peter Cooper on the occasion of the presentation of an address from the graduates and pupils of the Union, and we cannot do better than to quote them here:

"Let me then record that, during a long life passed in active business, I have never known any but evil consequences to all classes, and especially to the innocent, to result from strikes, lock outs, or other forcible measures designed to interfere with the steady and regular march of productive industry; and I feel justified in an earnest appeal to both workmen and capitalists henceforth to regard each other as equals and friends; and to imitate the great example so recently set by the enlightened governments of Great Britain and the United States, in the submission of their differences to arbitration, and not to expect to reform social evils by combinations designed to force either side into the acceptance of unpalatable terms, by the stern logic of starvation and indiscriminate ruin. Reform, to be of any permanent value, must be based upon personal virtue, not force; and it seems to me that the millennium will not be far off when each individual shall set about reforming himself rather than society, and conforming his life to the great law of loving God and his fellow men."

These are words worthy to be engraved upon the lintels of every workshop in the country; and if the precepts so eloquently presented by Mr. Cooper could be practiced by all classes of the community, we should hear fewer complaints of tyranny and oppression, and the mechanic would find his profession enriched by the presence of young men who are now driven to seek other avocations by the despotism of trade organizations.

DRIVING POWER OF LEATHER BELTS.

We have received many applications for information about belting, and our columns have become encyclopedic on the subject; and our subscribers are now beginning to call for precise statements and for definite rules for proportioning belts to the work required to be done by them. We therefore present the following as a brief summary of some of the more important and most fully determined facts bearing upon the subject.

The driving power of a belt may be limited by either of two things, its friction on the pulley or its strength. If it slip easily on the pulley, the limit of its driving power is reached long before it is strained to its maximum of strength, and, consequently, the belt is inefficient. If the friction is very great, the belt yields, if overstrained, by breaking or by tearing out the lacings.

To secure the best effect, the endeavor should always be made to obtain the greatest possible friction on small pulleys, and the strongest possible belts and lacings, or other connections, where the pulleys are large.

The relative frictional values of different surfaces over which belts may be run are given, by experiment, as follows:

Pulley of iron, covered with leather....	35	per centum.
" " polished.....	30	"
" " turned, but unpolished..	15	"
" wood, hard and polished.....	25	"

To obtain greatest friction, the grain side should be placed next the pulley, as the friction is very much greater when so placed. The neater appearance of a belt placed with grain side out must be sacrificed if full efficiency is to be attained. This difference sometimes amounts to one third. With the grain side to the pulley, there is less liability to crack also. Where pulleys are driven at very high speed, centrifugal force has the effect of reducing the pressure of the belt on the pulley, and thus of diminishing its friction.

The strain which is allowable upon a belt is variously estimated by different authorities, but is most frequently given at about 300 pounds per square inch of cross sectional area.

C. D. Abel gives one sixty-fourth of a square inch for each five pounds, or 320 pounds per square inch.

General Morin gives 355 pounds as the strain, per square inch, which may be borne for a long time without injury.

Haswell gives 350 pounds.

From the facts stated, it will be seen that the width of belt required will be determined readily, when the power to be transmitted is known and the speed at which the belt is run.

Mr. J. H. Cooper, whose papers in the *Journal of the Franklin Institute* (January, 1869, p. 42) we have referred to before, gives the following, on authority of Professor Thurston:

$$W = \frac{7{,}000 \times HP}{S\ V}; \qquad W = \frac{700{,}000\ HP}{S\ V\ t}.$$

The circular of Hoyt Bros. gives $W = \frac{5{,}334\ HP}{S\ V}$.

W = width in inches; HP = horse power transmitted; V = velocity of belt in feet per minute; S = length in feet of that portion of the circumference which is covered by the belt; t = tension.

That is, by the first rule, divide 7,000 times the horse power by the product of the velocity of the belt and the length of that portion of the smaller pulley which the belt touches; the quotient is the width required in inches.

An old rule among millwrights allows a belt one inch wide, running 1,100 feet per minute, for a horse power.

Care should be taken in putting up belts to lace or otherwise unite them so as to obtain a uniform strain across the whole width of the belts. Long belts should be used where possible.

Properly proportioned for its work, well made, well placed and properly cared for, a good belt should last many years, and then, if wide, may be cut into narrower belts for lighter work, and good service be obtained from it in its new application.

The pulleys should be turned and polished, or, when small, covered with leather. They should be carefully balanced for high speeds and, in many cases, tightening pulleys will be found convenient, and sometimes indispensable, for adjusting tension.

COPYRIGHTS.

The copyright law of the United States offers a variety of privileges of considerable value for business purposes, and we often wonder why they are not more extensively taken advantage of by enterprising individuals. One reason, doubtless, is because the scope of the law is not generally understood. We will therefore offer a few remarks upon the subject.

The 86th section of the patent laws of 1870 provides that any citizen of the United States, or any person resident therein, who may be the author, inventor, designer, or proprietor of any book, map, chart, dramatic or musical composition, engraving, cut, print, photograph, or negative thereof, or of a painting, drawing, chromo, statue, statuary, or of models and designs intended to be perfected as works of the fine arts, may obtain copyrights, which shall secure the exclusive privilege of printing, reprinting, publishing, completing, copying, executing, finishing and vending the same.

The copyright is in fact a patent, although not applicable to machinery. A copyright lasts for 28 years, at the end of which time it may be renewed for 14 years longer, by the author, inventor or designer, or, if deceased, by his wife or children. In applying for a copyright, no sworn papers are required, and no signatures; in fact, no forms or ceremonies are involved, nor tedious official delays. Parties who do not wish to attend to the matter themselves may for five or ten dollars have the copyright promptly procured for them by almost any respectable agent, the whole time required being only from two to four days.

There is no form of protection that is more easily obtained, or which gives better satisfaction so far as it extends than the copyright, and the simplicity and excellent practical working of the law ought to afford useful instruction to those who constantly aim to add complexity to our mechanical patent laws.

Under the copyright law, it is to be observed that designs for ornamental objects or configurations, prints, engravings, cuts, pictures, cards, and pamphlets of every kind may be secured. Almost every business concern finds it necessary to produce some peculiar work of this kind, large or small. Thus if a man makes a new drawing of his building, his machine shop, interior of office, view of the town showing his works, or any new and pictorial form for a border, or design to be used upon goods, circulars, or other purposes, he may, by simply securing a copyright, prevent others from imitating the same. It is obvious that the uses of the copyright are very extensive.

But it should be remembered that the copyright must be applied for *before the work is publicly introduced*, or, in other words, before it is published. A valid copyright cannot be had for a work that has been issued to the public prior to application for the copyright. Nor can a valid copyright be obtained for a mere trade mark, word, or name.

Further information in regard to obtaining copyrights may be had gratis by addressing Messrs. Munn & Co., 37 Park Row, Solicitors of Patents and Publishers of the SCIENTIFIC AMERICAN.

THE SCOPE OF THE INFINITESIMAL.

In a recent article on the astronomical effects of the ocean tides, we gave for the consideration of our readers some figures so large as to exceed all our ordinary notions of magnitude in regard to observation of time or extent of space; we will now pass to the other extreme, and contemplate some infinitesimally small quantities, measured in space by millionth parts of inches and in time by billionth parts of seconds.

The first step in this direction was made by Isaac Newton when he calculated that the thickness of the film forming a soap bubble varied from 3 to 6 or 8 one millionths of an inch; he accomplished this feat by observing the colors and comparing them with those produced when a lens with a convexity of long radius is closely pressed on a piece of plane plate glass, those colored rings being then formed which are still named after him, and in which the determination of the distances of the surface, at different points corresponding to each other, is a simple problem of elementary geometry.

The first steps in determining short periods of time were made when it was proved that sound travels the distance of one foot in less than one thousandth part of a second, while light requires only the 1,000,000,000th part of a second to traverse the same distance. When, later, the undulatory theory of light became established beyond any doubt, it was found that the length of the luminous waves varied from a fourteen millionth part of an inch to a twenty-seven millionth; while in regard to their duration, it was proved that a wave of red light lasts the 450,000,000,000,000th part of a second, while a violet wave lasts only about half as long.

Recently another step has been made in the research after the infinitesimally small dimensions of space. Whatever the nature of the ultimate constituents of matter, which we call atoms, may be, whether they have any material extent or are mere centers of forces of different kinds, one thing is certain, that their centers must be at certain distances; and investigations combined with legitimate deductions from the same have brought the investigators to agree that the distance of the centers of the atoms constituting ordinary solid and liquid bodies is very nearly one 250,000,000th of an inch. This gives for one cubic inch at least $250{,}000{,}000^3$ or 15,625,000,000,000,000,000,000,000 atoms, a number most prodigious, as it is easy to calculate that a single drop of water, weighing one grain, contains as many atoms as there would be grains of ordinary fine sand in a layer covering our whole earth

to a depth of 1,000 feet. Those atoms are kept in place by the coöperation of attractive and repulsive forces balancing each other: they are connected in piles and groups, or molecules, each group containing definite numbers; and the agglomeration of these groups forms a regular atometic or molecular network, out of which the well known chemical formulas may be easily explained in a graphic way.

In the act of crystalization, these groups arrange themselves in a symmetrical manner, according to the attractions and repulsions which place the molecules in position, wherefore we may consider the form of a crystalized substance as an exterior expression of interior hidden forces. This symmetric and uniform manner of arrangement explains at once why most crystals will, by heat, expand more in one direction than in another, why the light waves are transmitted in one plane or direction more rapidly than in another, and why this inequality in the distance of the atoms and groups of atoms or molecules will produce the phenomena of polarization and double refraction.

The hypothesis of certain speculative philosophers that the ultimate limits of the investigations in matters of small dimensions is infinitely beyond human computations, as we know to be the case with the mattersof large dimensions, the distant recesses of the universe, and the infinity of space, as revealed by astronomy, is thus set at rest. We know the limit of the atomic distances, but also that, when we have improved our microscopes till we may magnify objects thousands of times as much in their linear dimensions as we can do now, we will still be utterly unable to see the space between the atoms.

THE WRECK OF THE ATLANTIC.

One of the most dreadful marine disasters that it has ever been our province to chronicle has recently taken place on the coast of Nova Scotia. The White Star line steamship Atlantic, one of the largest of the fleet of ocean steamers plying between New York and Liverpool, on the morning of April 1st ran ashore and soon afterwards sank. The captain appears to have miscalculated in his reckoning.

When the ship struck, nearly all the boats were instantly swept away by the heavy sea, and in about ten minutes, according to the captain's statement, the ship keeled over on her beam ends, so that, with the exception of her bow and rail, her hull became submerged and large numbers of passengers were drowned. Out of 976 persons on board, 546 were lost, most of whom were steerage passengers.

The experience of countless wrecks has established beyond peradventure that boats, however well constructed, are not to be depended upon; and each succeeding casualty, with its scores of victims, renders more apparent the urgent need for some method which will serve to lessen the dangers of the sea. We have, repeatedly, brought up the subject, and at the time of the Metis and Bienville disasters of last year, we especially asked for it the earnest attention of inventors. We now do so again, and we would more especially advise those who are now wasting their time and genius upon flying machines, perpetual motions, and other impracticable and useless schemes, to devote their full energies to this over-pressing need. We want an effective and reliable life-preserving device. Let it at once be invented and proved capable, and the law is strong enough to compel its introduction and use.

THE PRESENT CONDITION OF ARCTIC EXPLORATIONS.

At the present time three great scientific expeditions are exploring the arctic regions. The Austrian party, under Payer and Weyprecht, are near Nova Zembla and to the north of Siberia; the Swedish expedition under Professor Nordenskjöld is cruising north of Spitzbergen, and the Polaris, fitted out by our own government and commanded by Captain Hall, is still in the regions north of the American continent. Owing to the prevailing bad state of the ice in the Arctic Ocean during the past winter, the crews of several whalers have been shut in on the coasts of Spitzbergen; several smaller expeditions have been despatched to their relief. The steamer Albert, equipped by the Norwegian government and commanded by Captain Otto, sailed for Tromsoe on the 20th of November, but, on account of the tempestuous weather, was compelled to return soon afterwards, after having reached lat. 77° N. The voyage was not without scientific result, as the temperature of the sea at the surface was carefully taken and found to be, even in the coldest weather, above the freezing point. At 230 miles northeast of the Isle of Baren, in lat. 75° 45', the temperature was found to be as high as 40° Fah.

In spite of the ill success of the Albert, the sailors of Tromsoe believed that the western coast of Spitzbergen was open, and that the Gulf des Glaces, the place where the shipwrecked whalers were supposed to be, was accessible. The bark Isbjärn was therefore dispatched and reached Baren on the 7th of January, only to return however, the captain reporting that to the north and east the sea was ice as far as the eye could reach. The weather was intensely cold,—50° Fah., and very stormy, while the season of perpetual night was at hand. From this report, as compared with that of the Albert, it may be noted that there is no ice from the coast of Norway up to the Isle of Baren; but in the latter locality, large quantities exist even in summer, being evidently transported thither by a cold current. A third expedition was fitted out for Bremen by M. Rosenthal, and consists of the steamer Groenland with 70 men. The vessel left on the 28th of January last, and although she has not been heard from, it is hoped that she has succeeded in penetrating the ice and relieving the survivors of the Norwegian whalers.

Dr. Petermann has recently published a map of the northern coast of Siberia between the mouth of the Yenessei river and that of the Lena. This region will serve as a base for the operations of the Austrian expedition. Recent advices from Russia state that the President of the Geographical Society of St. Petersburg has introduced a plan of a new scientific exploration of the northern part of Siberia, which will be carried as far as the Archipelago of New Siberia. Without doubt, this expedition will be productive of valuable results. Already, on the banks of the Lena, rich mines of graphite have been found and worked, while the surrounding regions contain numerous remains of mammoths and other great mammifers of extinct species. The exploration of this zone is confided to M. Tchekanowski, who with his party left Irkoutsk during March last.

France is taking but slight part in arctic investigation. Some time since we mentioned that a M. Pavy was about to sail from San Francisco, California, but it appears that an *affaire du cœur* not only prevented his sailing but brought him to pecuniary ruin; consequently the expedition was abandoned. In England it is stated that Mr. Leigh Smith, who, with Captain Ulve, discovered the extension of North East Land (one of the great islands of the Spitsbergen group), three degrees of longitude further east than previous observations had indicated, proposes to revisit that region with a screw steamer of 250 tuns.

SWINDLING OPERATIONS.

Some weeks since, we published an account of the nefarious transactions of an individual in the neighborhood of Galesburg, Illinois, who carried on quite an extensive business in swindling inventors. Representing himself as a patent agent and as having facilities for the sale of rights, his plan consisted in inducing the patentee to forward his model and five dollars to pay for advertising, and then leaving the package in the express office and pocketing the money. More recently, it seems, the scamp has played a bolder game, and by a series of artfully worded letters, held out tempting offers for state rights in inventions, has endeavored to persuade owners of the same to forward to him, as agent, deeds thereof, fully executed and transferring title in the property to a hypothetical person no other than himself. How many he has victimized, we are not aware; but his career as W. A. Morrison & Co. *alias* W. J. Reed & Co. is happily ended, as he has been arrested, convicted and safely lodged in the penitentiary.

We confess to but little sympathy for those who are foolish enough to forward the deeds of their patent rights to any person regarding whose honesty and responsibility they have not the fullest knowledge and confidence. An executed document of this description represents value exactly as much as title deeds to a house or bank notes, and like safeguards should be placed around all. There are plenty of adventurers in the country who stand ready to prey upon inventors—men who by offering dazzling bait too often succeed in swindling their victims out of the fruits of years of labor—and this reprobate who is now in the clutches of the law is but a fair specimen of the class. There is only one word of advice to be added, and that is to look well to the standing and character of all with whom you deal, and trust no offers which are not verified by your personal examination.

RESISTANCE OF WOODS TO TORSIONAL STRAIN.

Professor R. H. Thurston, of the Stevens Institute of Technology, communicates to the *Journal of the Franklin Institute* a description of an apparatus devised by him for determining the torsional resistance of materials, and also the results obtained by submitting specimens of different woods to experiment. By suitable mechanism, the force producing torsion is transmitted through the test piece and moves a pencil which traces upon paper a curve, the ordinates of which are proportional to the torsional moment while its abscissus represents the amount of torsion to which the specimen has been subjected, thus indicating the relative stiffness, strength and resilience, of the material experimented upon, very perfectly. The test pieces were seven eighths of an inch in thickness at the middle or smallest part, and were made from the following woods: White pine, S. yellow pine (sap wood), S. yellow pine (heart wood), black spruce, ash, black walnut, red cedar, spanish mahogany, white oak, hickory, locust and chestnut. The conclusions drawn from the results are as follows:

White pine yields quite rapidly as the torsional moment increases. The maximum strength of the test piece was 15¼ foot pounds, and it was twisted completely off at a total angle of torsion of 130°. The substance is thus shown to have little resilience. Yellow pine has much greater strength, stiffness and resilience. The sap wood is equally stiff with the heart wood, but sooner passes its limit of elasticity. Spruce is less stiff than white pine even, but possesses greater strength and resilience, its moment of resistance reaching 18 foot pounds and twisting through a total angle of torsion of 200°. Ash seems to be weaker and less tough than is generally supposed. Its most striking peculiarity is its very rapid loss of strength after passing its limit of elasticity. Black walnut is very stiff, strong and resilient, and is but little inferior to oak. Its resisting moment reaches 35 foot pounds, and one specimen attained a total angle of torsion of 220°. Red cedar is stiff but brittle, and loses all power of resistance after twisting through an angle of 92°. A torsional moment of 20 foot pounds only produced a total angle of torsion of 50°. Spanish mahogany is very stiff and strong. It is deficient in toughness and resilience, losing its power of resistance very rapidly after passing the limit of elasticity. White oak has less torsional strength than either good mahogany, locust or hickory, but is remarkable for its wonderful toughness. It passes its limit of elasticity at 15°, but loses its resisting power very slowly. The latter remains unimpaired to a torsion of 70° and yields completely at 253°. Millwrights are evidently correct in holding this wood in high esteem for strength, toughness and power of resisting heavy shocks and strains. Hickory has apparently the highest ultimate torsional strength combined with unusual stiffness and considerable resilience. Its moment of resistance to torsion reaches a maximum of 58 foot pounds. Locust has greater stiffness than any other wood on the list, and stands next to hickory in strength; it is also very resilient.

DIAMONDS APPLIED TO DRESSING AND WORKING MOLDINGS IN STONE.

The Gear Stone Machine Company, of Boston, have recently exhibited in this city, a newly invented machine for working stone, which surfaces, makes straight and irregular moldings panels, letters, upon edges and faces, carves, and in fact operates upon the hardest rock with as much facility and with nearly the same degree of rapidity, that a steel cutter penetrates a wooden board. The apparatus consists in simply a horizontal arm working freely from a standard and jointed at the middle. Rotary motion is transmitted by belting to a vertical shaft at the outer extremity, to which the cutting instrument is attached. Suitable appliances are provided for regulating pressure, vertical movements, etc., of the tool, and the table is made capable of adjustment to any desired hight. The chief merit and efficiency of the machine lie in the use of carbons or black diamonds and their arrangements in the cutting tools. The latter are made of steel, and the diamonds are so secured in them as to conform to the shape of the style of molding required. The operation consists in placing a wooden pattern upon the stone and clamping both firmly to the table. The workman then grasps handles above the cutter, and thus causes the latter, while swiftly revolving, to follow the lines of the model.

Trials conducted in our presence fully satisfied us as to the practical success and utility of the invention, as we saw the instrument cut moldings in stone, in a few seconds, which would take a man some hours to complete. The most refractory substances, such as hard granite, seem to present no more obstacle to the passage of the tool than the softest limestone, and the work is turned out finished with even more smoothness than would be possible by hand labor. For raised moldings, edge cuttings, and surfacing, the machine developes equal efficiency. There can be no question but that this is one of the most important applications of the diamond yet discovered, and its general introduction must tend to largely diminish the now great cost of preparing and dressing stone for building purposes.

The Canadian Patent Office Record and Mechanics' Magazine.

A new publication under the above title has been recently commenced at Montreal, Canada, by the well-known publisher, Mr. George E. Desbarats. It is issued monthly at $1.50 per annum, and embraces an official list of all patents granted in Canada, with the claims and reduced diagrams of the patent drawings. Added to this is a department of miscellaneous information, containing illustrations of recent interesting discoveries, general scientific news, etc. The whole forms a valuable publication, which reflects the highest credit upon its enterprising publisher, and deserves success.

Tracing Paper.

A convenient method for rendering ordinary drawing paper transparent for the purpose of making tracings, and of removing its transparency so as to restore its former appearance when the drawing is completed, has been invented by C. Puscher. It consists in dissolving a given quantity of castor oil, in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge. The alcohol evaporates in a few minutes and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or india ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet.

ARTIST'S RUBBER AND INK ERASER.—Quite a useful article of the above description has recently come under our notice. It is made of a patented composition and rubs out pencil marks with great celerity. As an ink eraser it is much superior to any of the compounds known to us now sold under the name, as it actually removes the ink, while it excels the ordinary scraper by leaving the paper with a surface that can be immediately written upon. It is supplied in a variety of convenient forms, at very reasonable prices, by Mr. J. H. Green, of No. 26 Beekman street in this city. Dealers in stationery and artist's materials will find this a profitable article to keep in stock.

PROGRESS OF THE HOOSAC TUNNEL IN MARCH, 1873.—Heading advanced from east end westward, 155 feet; from west. eastward, 162 feet; total extension of headings during March, 317 feet. Total lengths opened to April 1st, 22,798 feet; remaining to be opened, 2,238 feet, being 402 feet less than half a mile.

A LARGE DIAMOND.—The finding of a 288¼ carat diamond, at the diggings at Vaal river, South Africa, is announced. It is alleged to measure 1¼ inches in diameter, and is therefore one of the largest diamonds in the world.

New Jewelers' Tools.

M. Capitaine has devised several new tools for jewelers' use. His *boulet coussin* comprises in one instrument more than 300 matrices or forms of the usual descriptions mostly employed for shaping plates of gold and silver. It replaces the above number of dies in the workshop. The *chasse pierre* is a portable pincers, having on one part a steel tooth and in the other a cavity of variable dimensions. Its object is to remove delicate gems from their settings without endangering their being accidentally dropped. The same inventor has devised a way of setting precious stones upon concealed springs which allow them to move and appear more sparkling, and has also introduced bronze forms in the shape of truncated busts marked with radiating lines on which necklaces of jewelers can be fitted and the position of the stones or divisions of the work adjusted.

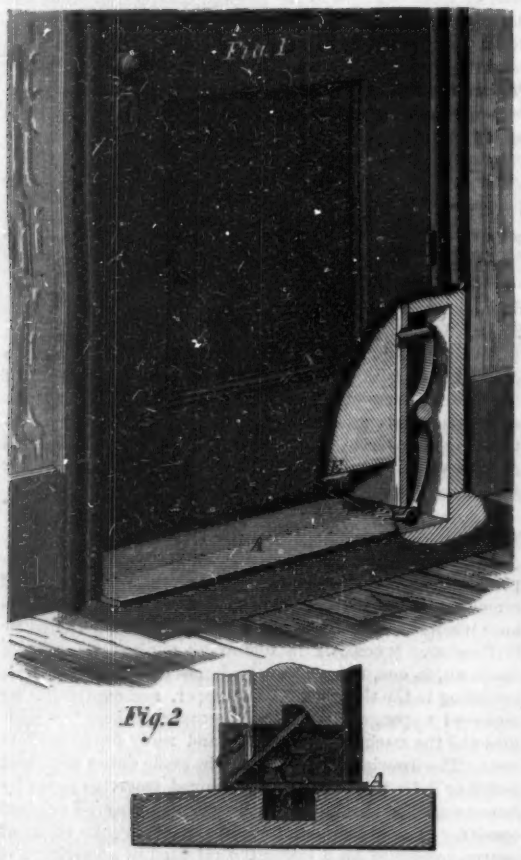
An Egg Within an Egg.

D. L. M. says that a resident near Grater's Ford, Pa., found, on March 4, a hen's egg as large as a goose egg. It weighed four ounces, and was three and a half inches long and seven inches around the middle or shorter diameter. The shell is very thin, hard and a little cracked. The egg, on being opened, was found to contain a yolk and albumen or white, and another perfect egg. The inner egg is two inches long, five inches around the middle, and weighs one and a half ounces.

WEATHER THRESHOLD.

Our engraving illustrates the application of an improved self-adjusting weather threshold to an ordinary door, the object being to prevent the entrance of drafts of cold air and dust, by closing the space between the bottom of the door and the floor. A portion of Fig. 1 is broken away in order to show the working parts, which are represented in section in Fig. 2.

A is a metal plate secured by screws to the sill, and, beside protecting the latter from water, may serve to hold down an end of the oil cloth or carpet. B is the movable door strip, provided with lugs at either extremity, which enter sockets in small metal plates fastened against the door frame



at C. D is a spring lever pivoted in a recess, as shown, and connecting at its lower end with a rod which enters a pocket, E, formed in the door strip, B. When the strip lies flat upon the plate, A, which is the case when the door is open, it swings the lever, D, so that its upper end projects inward from the door frame. As the door is shut, its jamb strikes against this projecting extremity, forces it in, and so moves the lever, causing the latter to swing the strip, B, into an inclined position. The strip then fits closely against or, as indicated in Fig. 2, into a rabbet in the bottom of the door, thus completely closing the aperture underneath.

The mechanism of this invention is simple and easily reached for repair, while it is probably of a more durable nature than the ordinary weather strip.

Patented through the Scientific American Patent Agency, January 21, 1873. For further information, address the inventor, John W. Kramer, Bloomsburg, Columbia county, Pa.

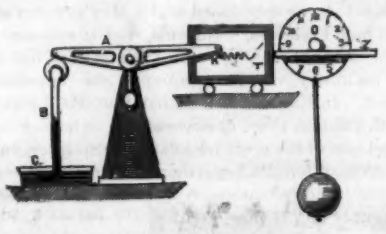
M. SORTAIS, in France, has invented an electrical device which is placed in the holds of vessels. In case of a leak or the entrance of too much water into the bilge, a current is established and a communicator is set in operation, signifying the fact to the commander and the officer of the deck.

THE velocity of circular saws at the periphery is from 6,000 to 7,000 feet per minute, or from 70 to 80 miles per hour.

RECORDING BAROMETER.

A is a fine balance lever with unequal arms and a regulating weight. B is a barometer tube, which is connected with one end of the lever, and the lower end of which dips in a trough of mercury, C. To the other extremity, K, of the beam, a pencil is attached. U is a clock, which, when in action, moves the rack, Z. This rack is connected with a vertical paper covered board, T, which is in contact with the pencil of the lever, and rests on rollers.

The action of the instrument is thus evident. The motion of the mercury in the barometer causes the lever to move up and down, and the pencil at the end of the longer arm makes a trace on the paper, which is gradually being pushed along according to the rate of the clock.

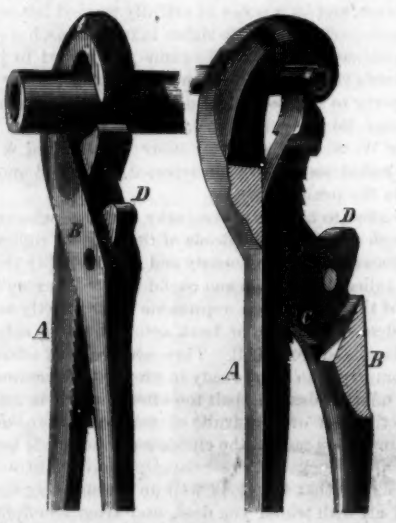


Time divisions are indicated on the paper, and it is recommended that a small hammer be made to tap the barometer tube occasionally, in order to prevent adhesion of mercury.

A recent number of the *English Mechanic* describes the above, and states that it is the invention of Professor Brahns, of Leipsic.

PIPE TONGS.

This invention is an ingenious form of pipe tongs adapted to fit any size of pipe. It is made in two portions—a



straight lever, A, and a hooked lever, B—the former passing through a slot in the latter. The back of the straight lever is notched and a serrated fulcrum piece, C, is pivoted in the slotted lever by a pin upon which the lever, B, receives its support when the tongs are in operation. The fulcrum piece is provided with a spring which retains its serrated edge in proper position to engage the notches in the lever, A. By means of the thumb piece, D, the piece, C, can be moved in either desired direction. When the tongs are open, the lever, A, can be moved within the slot and adjusted so that the instrument will fit on any size of pipe. The fulcrum piece, C, being pivoted, allows the full length of its serrated surface to come in contact with the similar portion of the lever, A, so that the parts always have a firm bearing upon each other and be subjected to an equal strain and wear.

To Mr. Andrew B. Lipsey, of West Hoboken, N. J., is due the credit of this device. Patented September 17, 1873.

A Photo-Improvement.

An improvement in photographic printing, by W. H. Jacoby, Minneapolis, Minn., is as follows: If the printing is to occupy one minute, the sensitive paper is exposed in contact with the negative for forty-five seconds, and the paper is then separated from the negative to a distance of, say, one eighth of an inch, and the exposure continued for fifteen seconds. This produces a sort of double printing, and imparts a soft mezzotint effect to the picture which is very pleasing. The separation of the paper from the negative is done by means of a peculiar construction of the printing frame.

A WINKING SITTER.—At a recent meeting of the Boston Photographic Society, Mr. Burnham explained some experiments he had made for the purpose of getting the eyes of a man who winked 364 times in one minute. The feat was accomplished by placing in front of the subject a black screen, with a hole large enough for the tube, and at the same time shutting off almost all of the light, giving (say) thirty seconds' exposure to the subject, and then holding before the lens a black velvet cloth for some thirty seconds. The eyes were perfect, and the experiment was successful.

By means of the spectroscope, astronomers have found that the atmosphere of Uranus is almost entirely composed of hydrogen gas. M. Protier remarks that if a very small proportion of oxygen also existed there, an electric spark would cause tremendous convulsions by combining the two gases.

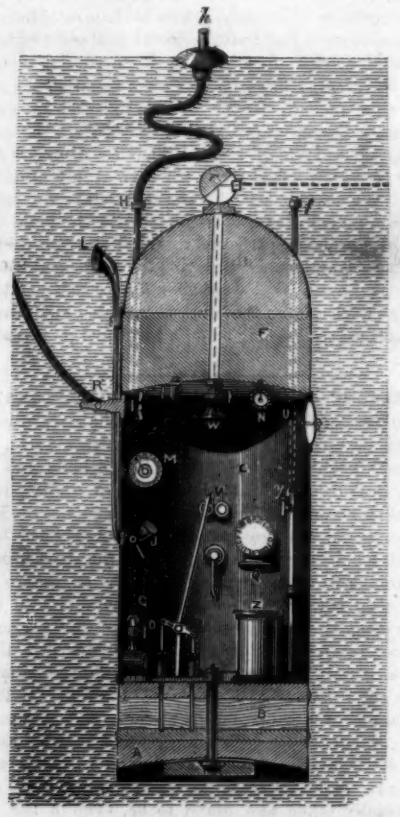
A SUBMARINE OBSERVATORY AND PHOTOGRAPHIC GALLERY.

M. de Toselli has recently invented an apparatus which allows of descent to considerable depths in the sea, in order to examine the natural productions and to take photographs of them, without inconvenience to the observer from pressure of air or of water, or other causes. He calls his machine a *taupe marine*, or marine mole. It consists of a long case, as shown in the annexed figures, taken from the *English Mechanic*, and is divided into four compartments. The chamber, A, is filled with lead to keep the machine vertical. Into chamber, B, water may be admitted by a stopcock, and can be expelled by means of the hydraulic pump, P. The chamber thus serves to increase or diminish the weight of the machine, so that it may sink or rise in the water as wished. The operator occupies the large chamber, C. The top chamber, F, contains respirable air, and is charged according to the time to be spent in the water. I is a cock by which the air is admitted into the principal chamber. G A is a metallic abductor tube, with stopcock, O, meant for expulsion of vitiated air. A caoutchouc tube from the upper extremity leads to a float, *h*, which has a valve allowing the egress of air, and preventing entrance of water.

The mole has a rudder and a screw (wrought by hand), which allow of its being slowly propelled in the required direction. M is a manometer, showing the pressure of the water, and thus the depth reached. N is a manometer, indicating pressure of condensed air at disposal in chamber, F. R is a rope connecting the mole with a vessel. It contains a metallic wire, by which and the telegraphic apparatus, Q, communication may be held with the captain of the ship. U is a manhole by which the observer enters. It has a double lid, and can be opened from without or from within. V are small glass windows of observation. Z is a seat, which may also serve for wardrobe.

The following difficulties are discussed by M. Toselli:—1. Suppose the abduction tube for vitiated air to be injured, so that it were necessary to close the cock, O. In this case the apparatus would immediately be raised for repairs, and, if necessary, the stopcock, Y, of the second abductor tube might be opened; this tube having also a valve at its upper end.

2. Suppose the electric wire broken, and it were necessary to communicate with the ship. The mole would be raised till the upper mouth of the speaking tube, I J, was above water, so that the observer might speak through it.



3. Suppose the hydraulic pump deranged so that the mole would not rise. Telegraph orders to draw up.

4. Suppose the pump, the wire, and the rope, to be all injured. The operator might then set free the weight, S, placed under the mole, and connected with it by a screw above.

5. Suppose, as an extraordinary case, that the ship were wrecked. The operator would first detach the rope at B, then rise to the surface, and having ascertained the right direction, proceed thither. For this purpose the mole is furnished with an artificial eye, *r*. This is a camera obscura, which, with the tube, W, enables the observer in the machine to see external objects as ships, rocks, etc. He can turn the tube in any desired direction.

COSTUS ROOT.—Dr. John R. Jackson, Curator of the Museums, Kew, states that: Its chief use is by the Mahommedans for burning as incense, but the Chinese also use it as an aphrodisiac. In Cashmere its only use is for preserving the celebrated cashmere shawls from the attacks of moths, pieces of the root being put into the bales in course of packing. When dry the root is of a dark brown color, very brittle and apparently full of resin, but it does not burn freely. It has a strong but agreeable odor, similar to that of orris root.

[For the Scientific American.]

MANUFACTURE OF COMBS.

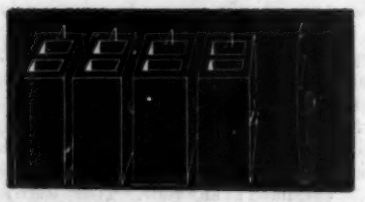
Very few persons understand how the combs, which we have in such daily use, are made. As we have recently had an opportunity of visiting a comb factory, we propose to give a slight sketch of the work.

The processes which each comb undergoes are many, though simple. In the first place, the rough horns of cows and oxen are brought in immense quantities to the factory. Each one is then marked for cutting. Some are marked in a circle,

FIG. 1.

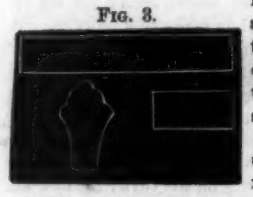
others in spirals (Fig. 1), so as to give a long strip, from which the round combs are made. After the marking, a rotating saw cuts them into these shapes, and also longitudinally, in order that they may be opened. The tips of the horns are of no use in making the combs, but they are by no means wasted; all are carefully preserved for making umbrella and knife handles. The horns are now boiled for four or five minutes in oil; whale oil is most common for this purpose. This softens the horn, renders it tough and somewhat flexible. A workman stands ready to take them from the oil, and places them, open, between flat bars. These bars are so arranged that a slight fire of charcoal in the center,

FIG. 2.



A, Fig. 2, keeps the horns warm enough to work with. By means of a wheel connected with the bars by the axis, B C, a very great pressure (of 400 tuns) is applied which, in three or four minutes, makes them perfectly flat. All the oil has been squeezed out, and the color changed from an opaque white to the translucent amber of the tortoise combs. As soon as they are taken from this pressure, they are cut into shape. This is easily done. The workman is provided with a variety of iron forms (Fig. 3), and uses the one most in demand and that will cut to the best advantage. He places the form on the horn, and with a single blow cuts it out. Of all kinds, except the fine combs, two are cut at the same time, their teeth interlacing.

FIG. 3.



The material is sometimes of unequal thickness, and in order to remove this difficulty they are passed under a great pressure.

The next process is that of cutting the teeth. This is one of the most curious and ingenious parts of the work. The ordinary dressing combs are heated so as to soften and make them malleable Then they are placed on an iron, E, Fig. 4, the size and shape of the comb, having ridges, both fine and coarse, for the teeth. This is under a machine with a sharp knife, D, attached, which, on being started, moves up and down, cutting the fine teeth. It stops of itself, requires to be slightly re-adjusted, and then cuts the coarse teeth. The two combs are then torn apart.

FIG. 4.

Next they are rubbed on a wheel covered with emery or some other rough substance, which takes off some of the superfluous material, but adds no polish, After this they are washed to cleanse them from the dust. On another wheel they are pointed. They are then placed in hot sand in order more effectually to soften them, and any little irregularities, such as the projection of the teeth too far at the end, are easily remedied by pressing the pliant horn.

The next process is polishing. This is done by rubbing them on wheels covered with emery. In fact the combs are continually going through the hands of workmen who, rubbing them a few times on the emery, add a little each time to the polish, until the last one puts the finishing touch to the whole work. This completes the dressing combs. The fine combs have the teeth cut in a different manner from the others. Each comb is fastened on a machine which moves back and forth against a saw. The machine is so arranged that as each tooth is cut the comb is moved slightly to the left to present a place for the next tooth. When the teeth are all cut, the machine stops and the comb is reversed. The grooves are made by passing the combs under a machine which scoops them out. After all the teeth are cut, the combs are picked out with a pin or needle, and brushed to get rid of any of the horn which still remains between the teeth. A polish is put on, and they are ready for packing.

After the long round combs, which are worn by children, are polished, they are laid on a hot iron. When heated, they are flexible and easily bound around a smooth cylindrical beam, where they remain until cold. When taken from this, they are in shape and ready for market. To some of them, however, a small piece is added, which stands up on the top. The ends, F G, Fig. 5, are bent over and fastened to the comb by small rivets. Colored ribbon is wound around the other parts. This is a new style and, to us, not very pretty. But it affords variety, and will undoubtedly find ready sale among children.

FIG. 5.

Most of the round combs, and some of the dressing combs are made of rubber instead of horn. This is prepared in Edinburgh, Scotland, and imported.

The high back combs which are very much worn as ornaments, after having the teeth cut, are each shaved by hand a little, and also by a machine. Then they are pointed, washed, polished a little, and carried to the engraver, who carves from a pattern. His only tool is hollow, much like a chisel (Fig. 6); with this he scoops out the various figures and curves. The combs are colored black, with acetate or sugar of lead, and, in imitation of tortoise, with lime, litharge, and potash. They are then heated and placed on molds to give them the requisite form. The difference between the real and imitation tortoiseshell is that the real has a much richer, more reddish color.

FIG. 6.

In this work nothing is wasted. The horn dust is of especial value as a fertilizer, and is carefully saved for that purpose.

One of the largest comb factories in this country is at Wappinger's Falls, N. Y., Elias Brown & Co., proprietors. Their product exceeds a hundred dozen in a day.

A Cure for Girdled Trees.

Since the winter of 1867 and 1868, there have been none more favorable for field mice, says the *New York Tribune*, than the one just ended. Over a wide range of country the ground was covered with a heavy body of snow in December. This was added to by frequent storms, and it remained during the entire season. In closely planted orchards, the snow was piled in places several feet in thickness for eight or nine weeks, and afforded just the conditions most propitious for these active pests.

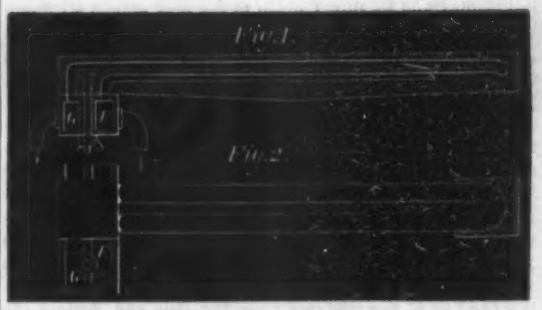
Under such circumstances it will be strange if, on disappearance of nature's blanket, thousands of fruit trees are not found girdled, especially those standing in or near grass land. Trees from which the bark has been gnawed all around and six to twelve inches in width, are sure to die within a year unless prompt measures are taken to make connection between the bark above and that below the wound. The prescriptions which have been published from time to time are as numerous as flies in midsummer, and most of them as unsatisfactory. Where only a third or a half of the circle has been made, leaving a connecting strip, then, by covering the bare part with a coating of cow droppings and yellow clay, the young bark will grow over the mound much sooner than if left exposed. Where there is no such connection, however, the best and most simple method of forming one—and the method that never fails—is to insert scions (one, two, or three, as the case may require), bridging over the barked part as in the foregoing picture, which is an exact drawing of a pear tree that four years ago was girdled, and (with many others similarly treated) is now in prime condition. The method is simple and rapid, and most any one can do the job without difficulty. Take the scions of last year's growth of wood, from young healthy trees, cut them the right length, bevel each on the same side at both ends. Then, with a budding knife, make an incision in the bark of the tree above and below the injured part, and carefully press the scion in place. Cover over where the incision was made with grafting wax, and then wind around the stem of the tree, at both ends of the scions, some narrow strips of bass matting, which will keep them firmly in place. For trees from which the bark has only been gnawed half or two thirds the way round, one or two scions will be sufficient; but when there is no connection left, it will be found advisable, particularly on a large sized tree, to put in three scions. The work may be done at any time between the 1st and 10th of April. The figure at the left represents a scion prepared for setting in the way suggested. When we consider the ease with which damage by mice may be remedied in this simple manner, the person who permits his girdled trees to be destroyed will deserve little sympathy for his loss.

THE locomotive returns from fifty-one railways, for November, 1873, published in the *Railroad Gazette*, show an average expense of 22·18 cents per mile for each locomotive. 2,682 locomotives were employed, and they traveled a total distance of 6,958,616 miles.

IMPROVED WATER FIRE-GRATE.

This is an improvement by R. J. Ellis, Liverpool, England, and recently published in the *Engineer*. Our engraving shows two methods of construction, one showing cast iron bars having the water channels formed in them, the other a bent wrought iron tube.

It will be noticed that in each of these arrangements the bars are fixed at one end only, the other end merely resting on a bearer, so that the bars are quite free to expand or contract. The bearer to which the bars are bolted contains two channels, F G, communicating with the passages through the bars, as shown. The feed water for the boiler is pumped into the channel, F, in the bearer, whence it circulates through the bars, returning to the channel, G, from which it passes off to the boiler in a highly heated state. The joints between the bars and bearer are made tight by suitable packing rings.



It is claimed by Mr. Ellis that this arrangement of bars not only forms an efficient feed water heater, and adds materially to the heating surface of the boiler, but that from the bars being kept comparatively cool, trouble from clinkering is avoided. The plan of pumping through the bars insures a good circulation through the latter, and the system of construction admits of the bars being readily removed from the bearer for the purposes of cleaning or renewal if necessary.

Correspondence.

Fire Alarms.

To the Editor of the Scientific American:

Some time ago you published an article in which I described a fire alarm, made with strips of sheet zinc and iron soldered together, these being the metals which differ most in expansibility. Wood is so little lengthened by heat that it is used for pendulums of clocks; and I have tried a piece of a tube of zinc (the most expansible of metals) such as is used to conduct bell wires, 18 inches long, laid on a piece of wood with one end of the tube fastened to it. At the other end of the tube is a small hole made in the side, into which is inserted a pin or point of the short end of a 6 inch lever, moving on a pivot ¼ of an inch from the tube, giving the long end fifteen times the motion; this can be moved sufficiently for a fire alarm by the heat of the breath blown through the tube, thus: I made another by adding an additonal lever the tube, with levers fastened to the board at a, b and c, thus:

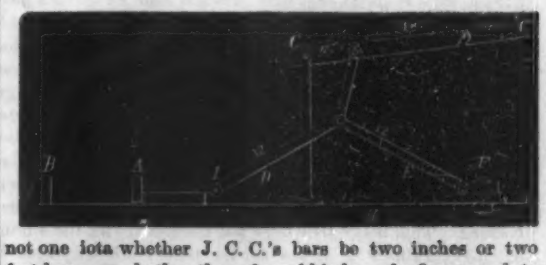
This latter will increase the motion 150 times; and in a room at a temperature of 65°, the heat of the hands will move the end of the second lever an inch and a half. S.

The Power of Compound Levers.

To the Editor of the Scientific American:

Having noticed, on page 195 of your current volume, a communication from J. C. C. as to the power of compound levers, I herewith give the equation for the same, together with a solution of his problem.

The form of compound lever known in mechanics as a "knee joint" has for its proportion P : W :: 2 R : tan ½ a; a being the angle between the bars. Now J. C. C. desires to know what power would be exerted on the head, A, when the joint is acting at its fullest efficiency, the power arm of the lever, C, being to the weight arm as 8 to 1. A glance at the proportion for the "knee joint" shows that it matters



not one iota whether J. C. C.'s bars be two inches or two feet long, or whether the value of his lever be 8 or equal to that of Archimedes. The power of the knee joint, when the angle between the bars approximates to 180°, is approximately infinite; for, just in the same ratio that the extreme

tan ½a increases, the other extreme, P, diminishes, and when ½a=90°, its tangent = ∞, hence P is then infinitely small. Conversely, when the bars are together, P must become ∞. The following equation gives the value of the lever or joint for all angles: W=P½d÷2h, or P : W. :: 2h : ½d; h being the hight of the joint from the plane on which it slides, and d the distance from F to I. R. D. WILLIAMS, Ph. D.

Baltimore, Md.

Construction of Dwellings.

To the Editor of the Scientific American:

In J. H. L.'s communication, printed on page 180 of your current volume, there are a few improvements required to make just such a house as I think he wants. He proposes filling in between the studding flush with the inside and outside, then plastering upon the filling without furring off, as is usual. His house, if so constructed, will be damp upon the inside; and by this, I mean to say that almost all damp walls are so, not from passage of damp through them, but by condensation of inside moisture; if there be an air space between the plaster and the wall, his house will be warmer, because such space is a nonconductor. Therefore, to follow out his plan in part, I will commence with drain tile, as recommended in an excellent article in the SCIENTIFIC AMERICAN of March 22, entitled "Complete Drainage of Dwelling Houses." After getting the drain in place, I should run up a foundation of stone or well burned brick; on top of foundation I would lay 2×8 plank all around for sills; place the joist, and secure it from toppling over with strips. Then nail the joist into the sills, and erect the rest of frame, resting the foot of the studding upon the sills and against the joist, to which nail securely. Carry foundation to top of first floor joist. I find that more cold comes in through floors than warm air escapes by absorption or bad joints in walls; therefore I should nail strips, three or four inches from top of joist on each side, and cut in any waste lumber upon which I should spread mortar (concrete would be better) to within an inch of the top of joist; and I would serve the upper floors the same. In laying floors, run the flooring back again, filling in walls; this will form a preventive against fire. Now when the four inches of filling is in place, I would fur off with inch strips and lath before plastering; or I would start in the beginning with six inch studding, making a two inch space of air in place of one, as in the furring mentioned. As for fire, if the brick or stone foundation is carried to top of joist, the flue J. H. L. speaks of is closed at bottom; if the upper floor is carried back to filling in, we have stop number two; then the plate upon top of wall forms the third stop in flue. And we have as nearly fireproof a house as the general run of brick buildings, if not better. Even in houses with no filling between studding, if the floors are carried back to the sheathing, or pieces cut between studding at this point, the mortar that always falls from the clinch will make an almost air tight joint. But carpenters who take a job of building, competing with perhaps a dozen others, cannot be expected to do any little extras, and now-a-days buildings are oftener thrown together than otherwise, built to sell, stylish outside, relying too often on paint and putty to cover bad joints. C. H. BARNES.

Chicago, Ill.

Relics of the Mound Builders.

To the Editor of the Scientific American:

On page 184 of your current volume, in an article entitled "The Relics of the Mound Builders," occurs the following sentence: "The most peculiar feature about the formation of the skeleton was that the arm at the shoulder connected with a short strong bone that was connected firmly with the sixth joint of the backbone, counting from the head." A bone reaching from the shoulder to the sixth cervical vertebra is a new feature in human osteology. This excited my curiosity, and I wish to enquire if other skeletons of these mound builders have not been found; and whether this extra bone is common to them all, or whether this is a single example, and ought to be looked upon as a *lusus naturæ*? If common to all, then we have some fragmentary knowledge of a race of human beings entirely unrelated to the race of Adam, but another and extinct species of the same genus. I say another, for the skeleton found in one of the caves of Italy, in immediate juxtaposition with the skeletons of the extinct tiger, cave bear, etc., shows pretty conclusively that these animals and man existed contemporaneously, probably long before Adam and Eve were created. In saying this I do not wish to be understood as denying revelation or any of the truth contained in the Old Testament. Of course it could not be expected that Moses, from his very limited means of knowledge, most of which was legendary, would attempt to enlighten mankind about the fossil remains of extinct men and animals, of which he could know nothing. Geology shows very conclusively that creation and extinction have been the natural order of nature, that the conditions favorable to a given form of life have ceased, and therefore, that that form must have necessarily become extinct; and the evidence is the fossil remains belonging to this or that geological age. Fossil remains of many animals and plants exist in latitudes where the living specimens have ceased to exist for an indefinite period of time. It seems a fair inference, then, that this Italian skeleton and, perhaps, these mound builders also were of species extinct long before our progenitors were created. This being true does not necessarily fix the stigma of untruthfulness on Moses, for he could not be expected to know what the combined researches of science for ages have but just unfolded. His history was in accordance with the best light he had, and he undoubtedly believed it to be true.

R. K. SLOSSON.

Deep Sea Soundings Without a Rope.

To the Editor of the Scientific American:

The present mode of obtaining deep sea soundings is extremely laborious, and by no means satiffactory. Not only is it requisite to lift an enormous weight of rope, but the large surface of the latter enables any deep oceanic current to carry it away from the perpendicular and so mislead the observer.

Recognizing these difficulties it occurred to me some years since that it might not be impossible to dispense with the rope altogether and to ascertain, at least approximately, the relative depths of various parts of the ocean with infinitely less trouble. By letting a stone fall down a shaft, and carefully noting the interval of time between its movement from the surface and its arrival at the bottom of the shaft, it is easy to determine the depth of the latter, which is the distance traversed by the falling body. All systematic works on natural philosophy give the rules for estimating the space passed through during each second by a heavy body falling in air. And it is surely possible to obtain the same information with respect to heavy bodies falling in water or light bodies rising in it. Now the plan which I have in view for deep sea soundings is based on the same principle as that long used to determine the depth of shafts, namely, by simply noting the time required for the falling body to reach the bottom; but in the ocean depths we could not readily tell when the weight touched the ground, and therefore a more complicated, but by no means insuperable, problem is there presented. Thus, if a body specifically heavier than sea water is allowed to sink at the surface of the ocean, it will at the end of a certain time, varying with the depth of water, strike the solid ground below the latter; and if at that moment the specific gravity of the body can be so changed that it becomes and remains lighter than water, it should at once begin to ascend until it again reaches the surface of the sea. Then by simply observing the time required for the descent and ascent of the body, and dividing that time properly according to ascertained laws for the descending and ascending movement of the body, the ocean depth at the spot would be approximately known. The arrangement which I should propose may be outlined in a few words. Have a strong iron cylinder, with a close fitting piston, so contrived that when the latter is at the top of the cylinder, both being placed vertically, the apparatus will readily sink in water; but when the cylinder is filled with gas, the piston being at the bottom of the cylinder so as to retain the gas and being prevented from compressing the gas by a mechanical contrivance, the apparatus will be lighter than water and consequently ascend in it. There is no difficulty about the sinking of the apparatus, and the ingenious devices now in use, for detaching extra weights and causing sand, etc., to adhere to part of the apparatus, might also form part of this arrangement. For changing the specific gravity of the apparatus at the bottom of the sea, I would employ a simple contrivance like that of some of the earlier torpedoes, by means of which some gunpowder, placed in or near the top of the cylinder, should be ignited. As soon as the apparatus struck the ground, the resulting gases would force down the piston and fill the whole space of the cylinder so that it should at once become lighter than the surrounding water.

Believing that any plan tending to facilitate the acquisition of more correct information respecting the depth and bed of the ocean is not without some public interest, I submit these rough ideas to the consideration of those more immediately interested in the subject. It is gratifying to observe that civilized governments are now more than ever recognizing oceanic science as a common field for peaceful international rivalry; and the naval department of the United States, especially in connection with the official labors of the late Captain Maury, has already honorably distinguished itself in this great and useful work. Experiments of the kind now proposed are beyond the means of private individuals, and would seem to be among those which national authorities may legitimately undertake.

New York city. GEORGE ROBINSON, M. D.

The Comet of 1866 and the November Meteors.

To the Editor of the Scientific American:

It is now admitted that the comet of 1866 and the meteors of November 14 move in the same orbit, and that the latter are the *débris* of the former's disintegration. This comet, near its ascending node, passes almost exactly through the orbit of Uranus; hence, in all probability, the present form of its path is due to the disturbing influence of that planet. The date of this change in the cometary orbit is fixed by Leverrier in the year 126 of our era. That the first appulse, however, of the planet and comet must probably have occured at a more ancient epoch is undoubtedly indicated by the following facts:

1. The meteoric showers observed in the years 931 and 934, as compared with those seen from 1866 to 1870, show conclusively that the lengthening of the meteor cloud in the last 940 years has been less than that between the first perihelion passage of the comet and the year 931. In other words, the diffusion of meteoric matter in the early part of the tenth century was too great to have been effected in so short a period as 800 years.

2. Dr. Oppobser's period of the comet of 1866, computed from four weeks' observations, is 33·176 years, and this is the value which indicates a close approach to Uranus in A. D. 126. This period, it must be admitted, is liable to some uncertainty. Have we any probable data by which it may be corrected?

The identity of this comet with that of 1366 was suggested by Professor H. A. Newton soon after its appearance—a conjecture which subsequent research has strongly confirmed. It is also probable that the comet observed in China on the 29th of September, 1133, (Williams' "Observations of Comets," p. 65,) was a former return of the same body. The interval between 1366 and 1866 is equal to 15 mean periods of 33·283 years. With this value of the periodic time and the known secular variation of the node, it is found that the comet and Uranus were in close proximity about the beginning of the year 547 B. C. It is not improbable, therefore, that the former was at that time thrown into its present orbit by the attraction of the latter.

If, then, as seems highly probable, the comet of October, 1366, was a former return of that which passed its perihelion in January, 1866, it is easy to find that the same body will make a near approach to the earth about the 16th or 17th of November, 1965, and to Uranus in 1982–3. At one of these epochs the cometary orbit will probably undergo considerable transformation. DANIEL KIRKWOOD.

The Boiler Explosion at Conshohocken, Pa.

To the Editor of the Scientific American:

We notice in your issue of April 5, in your Answers to Correspondents, a communication from W. S. B., who says he was at Conshohocken, Pa., with Mr. Le Van when he examined the boiler exploded there on February 3; and as we know the high standing of the SCIENTIFIC AMERICAN as well as its proprietors, before the public, we think you do not wish to have us misrepresented or to let errors and falsehood go uncorrected. If we saw what W. S. B. says in some of the sensational newspapers, we would let it go unnoticed; but cannot do so when it appears in your widely circulated journal.

We reply by saying that every word that W. S. B. says in that communication is false and malicious from beginning to end; and we only wonder what inducement or expectations Mr. W. S. B. can have in view in publishing such a string of falsehoods. He cannot find any part of the exploded boiler three sixteenths of an inch in thickness; it is all here yet and can be examined at any time. There were not so many persons killed as he represents, and none of the wounded are crippled for life, all being well and at work. We never carried 125 lbs. pressure on the boilers, but only 85 lbs., and we never exceeded it. There is no boiler here with 18 patches upon it, and never was, or anything near it. He never saw such a boiler here in his life. He never heard the proprietor say last summer, in reply to the engineer's opinion that they were carrying too much pressure (from 100 to 110 lbs.) that it was all nonsense, that those boilers were able to stand 150 lbs. pressure. He never heard such a remark in his life or any thing like it. He has made this story up out of the whole cloth. He says the trouble was that they wanted one man to do three men's work, and one man was doing it for less than one good man's wages. How absurd is this statement! A man is not likely to do three men's work for one man's wages, as you well know. The fact is that the engineer in charge of the boiler at the time had the engine to stop and start two or three times on his turn; he had six boilers to attend to, looking after the water only (no firing to do), beside oiling; this was about all he had to do whilst running, for which we paid him twenty-two dollars per week; about seven dollars per week more than engineers get here for running at blast furnaces where they run seven turns per week, and about six dollars per week more than most engineers get for running in rolling mills. We paid him extra because we thought he was a superior man, and we pay more to engineers than any one else in same business (to one we pay twenty-six dollars); and they have been here for over ten years. In many places engineers have double or treble the number of boilers to look after that we have here; so that it does not look as if one had to do the work of three men. We have the reputation of paying a good price for everything we get, labor not excepted; our men make as good wages and are paid as promptly as any in the country.

We wish to state to you, as it may benefit others as well as ourselves, that we had the boiler spoken of by W. S. B. (as taken out from the side of the exploded one) and the one which, he says, has 18 patches upon it, tested with hydraulic pressure, and it was taken out for that purpose. It was tested by Mr. Farren, one of the Hartford Boiler Insurance Company's inspectors, to 175 lbs., with ice cold water, without showing any signs of strain or leaking a drop, or sweating at a seam or rivet. This test, Mr. Farren says, (according to experiments made at Morris, Tasker & Co.'s works with boiler tubes, etc., who say that one pound of cold water pressure is equal to two of steam) is equal to 350 lbs. of steam pressure; we do not, however, assert this as a fact. It is no doubt much more severe than steam pressure; and under the steam boiler laws of Philadelphia, they allow steam one third less than the cold water test to which they subject them to be carried. This would have given us the privilege to carry 117 lbs. steam on this boiler; W. S. B. says there are worse boilers working in the mill today than this, carrying from 60 to 125 lbs. steam. This is false also; we have not worked any in this mill since February 3, not being ready yet to start. But what boilers we have at this mill have been all inspected by the Hartford Boiler Insurance Company, and they have no hesitation in giving us a policy of insurance to run them at their risk. We presume they ought to know something about boilers.

Mr. W. S. B. has the advantage of us, as he is unknown to us; and as we do not know where to look for him, and he knows us, we extend to him through you a polite invitation to visit us, as it would give us much pleasure to talk the matter over personally with him. He might give us some valuable information, perhaps. We will state one thing

more: The Hartford Boiler Insurance Company's inspectors say they do not care for the age of a boiler, that they only look for the quality of the iron, thickness of sheets, diameter, and workmanship, and that they often find old boilers better than some new ones. WOOD & BROTHERS.

Conshohocken, Pa.

THG GOVERNMENT SUBMARINE WORKS AT HELL GATE.

We should advise people of a nervous temperament, who contemplate visiting the excavations at Hell Gate, to refrain from entering the wooden shanty, in which a laboratory for the making and filling of the nitro-glycerin cartridges has been extemporized. Not that there is any positive danger—for 16,000 pounds of the material have been handled and used without an accident—but the sight of gallons of liquid destruction surrounding one, and the knowledge that should it explode utter annihilation would be the result, is calculated to send a disagreeable tremor even through the strongest organizations.

The nitro-glycerin destined for use at Hallett's Point is transported from the place of its manufacture and stored, several hundred pounds at a time, in a small arched concrete building, erected on a reef known as Flood Rock, situated in the middle of the river. From here it is carried to

THE NITRO-GLYCERIN LABORATORY,

which is located at some distance from the other buildings. The floor of this shop is covered with a thick layer of dry plaster of Paris, which serves to absorb, and render harmless, any drops that may fall upon it. Within the apartment an equable temperature of from 65° to 70° is maintained throughout the year; steam pipes, carefully guarded, affording the necessary heat in winter, and a chest of ice serving to lower the warmth in summer. The thermometer is in fact the principal safeguard, for if in cold weather the nitro-glycerin is allowed to fall below the above mentioned temperature, it is liable not to explode when fired, while if on warm days it should become heated to excess, spontaneous combustion is apt to ensue.

THE CARTRIDGES

are made of heavy manilla paper and vary in size, according to the amount of explosive they are to contain. A sheet of paper of suitable size is first wound over a roller, for half its length, then the other half of the leaf is covered with thick glue, when the whole is tightly rolled around the form. One end is folded and closed, and the case is slipped off the cylinder and covered with a waterproof mixture of Stockholm tar, resin and tallow, great care being taken that every portion inside and out receives a complete coat. This dried, the cartridge is filled with nitro-glycerin, the workman having several quarts of the explosive in rubber vessels on the table before him, and apparently handling and pouring it with as much coolness as if it were water. The case filled, the electric fuse is inserted. This is either one of the patented fuses or an arrangement of fulminating powder at the end of the wires. Chlorate of potash is principally employed, as it is some fifty per cent cheaper than either fulminate of mercury or of copper. The upper end of the case is then twisted around the wires and covered with a thick mass of the tar compound, when the cartridge is ready for use.

The principal point to be guarded against in making these cartridges is that they shall be impervious to leakage. This is plainly evident from the fact that, should such not be the case, a portion of the dangerous liquid might escape and spread through fissures in the rock after the charge had been inserted in the hole. Not sharing in the general explosion, the presence of the nitro-glycerin in the cracks would not be known until struck by a drill bit, when of course a terrible disaster would result.

The number of cartridges made in the laboratory depends upon the requirements of the works; it ranges from 100 to 250 per day. About 1,000 pounds of nitro-glycerin are used monthly.

EFFECTS OF NITRO-GLYCERIN.

Did we seek a word to express the effects of this powerful explosive, we should fix upon "pulverizing," for such is indeed the case. One hundred pounds of nitro-glycerin placed upon the surface of granite rock fairly reduces the stone to powder. Its action under water was well shown in the recent blasting of a reef near Hell Gate. The rock was entirely submerged, of considerable length and of peculiar shape, its upper portion forming an overhang. The first trial was made with a cartridge containing 12 pounds of nitro-glycerin, placed under the projecting ledge. It is supposed that a passing steamer generated a current which carried the charge some fifty feet away from the reef, for when it was exploded, a column of water hundreds of feet high was thrown into the air, while the surface was covered with dead fishes. The rock was untouched. On making the second attempt, several cartridges were firmly secured in proper position and fired. This time the water was raised hardly six inches, but a diver, after descending, reported that the reef had disappeared, leaving the bottom at a uniform level.

NITRO-GLYCERIN COMPARED WITH OTHER EXPLOSIVES.

Nitro-glycerin is some thirteen times more powerful than gunpowder, and consequently, from its greater force, it accomplishes different results. In using powder in the Hell Gate blasts, the rock was split off in masses often weighing several tuns each, which required a large amount of hard labor with heavy sledges to reduce to a portable condition. With nitro-glycerin the latter work is no longer necessary, as it is rarely that a fragment exceeds one hundred pounds in weight. Dynamite and dualin are considered as uncertain in effect and explosion, and consequently of greater danger than the pure nitro-glycerin. For small holes varying from 1 to 1¼ inches in diameter, dynamite, we were informed, had been used to good advantage but for larger blasts, of 2 inches and over, nitro-glycerin is the superior. Lithofracteur has not been tried, as it is stated that none can be obtained.

HOW THE WORK IS TO BE CARRIED OUT.

As we said in our previous article, it is the present intention to extend the headings until all shall reach a point above which 32 feet of water exists. After the seven galleries are completed, the floor of the entire excavation will be lowered some fifteen feet in order to give the roof a clear fall of about forty feet. It does not appear to be the design to follow out the original idea of cutting chambers in the supporting pillars in which to place the nitro-glycerin; though the exact method of arranging the exploding charges is not as yet definitely determined. The opinion among the officers of the work is that the piers will be cut entirely away, and the roof supported by heavy wooden crib work. The nitro-glycerin will then either be placed at suitable points in barrels, or else will be contained in tubing, laid close to the roof throughout the entire chamber, the whole arranged with electric fuses being connected with a battery. The water will then be allowed to enter the main shaft, completely fill the excavations and thus act as a tamping. The nitro-glycerin is designed to act upon the roof, shattering it to fragments which, falling to the floor, will at once leave a sufficient depth of water. By this means the slow and expensive process of subsequent dredging is hoped to be avoided.

Tremendous as the explosion will be, the water tamping, it is considered, will effectually prevent all danger to adjoining buildings, though in all probability a very near approach to an earthquake will occur in the neighborhood. When this final "blow up" will take place it is difficult to state. Congress has been by no means lavish in appropriating funds to carry on the work. About $600,000 we are informed, is necessary for its completion, but the progress toward the latter is dependent upon the rate at which the necessary money is doled out.

OTHER GREAT EXCAVATIONS AND CUTTINGS.

No better proof of the excellence of the plans of General Newton can be afforded than the complete success of similar operations undertaken to remove the obstructions in the harbor of Valetta, on the island of Malta. The same general design of work was copied and the result was a complete removal of the dangerous reefs. It may be acceptable, in concluding our notice of the Hell Gate excavation, to glance in brief review over other and similar works both completed and in progress, and in the same connection, to remark the performances of the drill which, in our previous article we demonstrated to be of such practical value. In

THE HOOSAC TUNNEL,

less than 8,000 feet remains to be cut. This will be done before November, 1873, and it is stated that cars will be regularly running through the great bore before March, 1874. The contractors for the work, the Messrs. Shanly, state that by using the Burleigh drill a gain of 33 per cent over hand labor was obtained, which will enable them to complete the tunnel in five years less time. It is only necessary to compute the loss (which would accrue if the capital invested in defraying the cost of the enterprise $10,000,000 were allowed to lie idle as it would do, if the tunnel could not be used for five years longer) to show, that by the use of the drill above mentioned, not only a saving of time, but a large saving of money has been effected. The cost per yard of the Hoosac tunnel, although the rock is harder, has been less than that of the Mont Cenis tunnel, where the Sommellier drill was employed.

THE ST. GOTHARD TUNNEL,

piercing Mont St. Gothard in Switzerland, is to be thirteen miles in length. As the Hoosac bore is 4¼ miles, and that through Mont Cenis 7¾ miles, the above mentioned great cutting will be longer than both together. The Burleigh drill, we learn, is to be used throughout the entire work. The

NESQUEHONING TUNNEL,

at Mauch Chunk, Pa., was completed in less than two years by the Burleigh drill, when it was plainly proved that, if hand labor had been employed, at least five years would have been required: 1,000 feet of the cutting was through conglomerate rock, the hardest known in the country. In headings where 15 feet per month was considered an excellent rate of advance by hand labor, the machine above mentioned accomplished from 80 to 90 feet in a similar period without difficulty.

Spring Dangers.

Doctor Hall, in his *Journal of Health* for April, says: March, April, and May are more fruitful of sickness and death than the other months of the year; not so many die as in July, August, and September, but there is more disease, arising mainly from sudden changes of the weather, injudicious changes in clothing, and errors in eating. The causes of sickness and death are avoidable; hence, we are the authors of our own sufferings, which are irrationally attributed too often to the "mysterious dispensations of Providence." The difference to the reader between attention to and neglect of some of the following suggestions may be vigorous health or a shroud before midsummer.

In March there is a searching rawness and dampness in the atmosphere which chills the blood in such a way as to lay the foundation for a multitude of colds, fevers, and inflammations. In April the atmosphere is not so much saturated with dampness, but the fires are early put out, and the winter clothing is too soon laid aside, in whole or in part. In the beautiful May, the mornings and evenings are damp and chilly; the warmth of midday tempts many to lay aside the warmer clothing, and this lighter clothing, together with the absence of fires, makes a difference sometimes of twenty, thirty, or even forty degrees. But, in addition to these, there is another cause of disease, almost universal, prevailing through all the three months. No one thinks of building as fierce fires in the spring time as in midwinter, because there is not the same necessity for artificial heat; the external air is not nearly so cold, but we kindle as great an internal heat, which is excessive, and that is fever, and fever is followed with cold within twenty-four hours as certainly as a pendulum, carried to the right, if let go will swing to the left; one is the re-action of the other, a fixed law of our being. If the system were kept in an equable condition of warmth within and without, we would have neither fevers nor colds, chills nor inflammations.

We eat for two reasons; to sustain and to warm. A large portion of our meats and butter and bread is composed of the warming principle, carbon, the province of which is to produce animal heat; hence, if we eat as much in the spring as in the winter, there is inevitably too much internal fire, and that is fever. In the spring everybody gets weaker because the weather is warmer, and yet we eat with the winter's appetite until Nature begins to take it away; then we begin to think that something is the matter, that we are going to get sick; but, instead of being content to diminish the quantity and quality of our food in proportion to the diminishing appetite, we begin to stimulate that appetite by "tonics" and "bitters," meaning thereby whiskey in disguise, for it is scarcely possible to find a tonic or a bitter or an appetizer of which alcohol is not a large constituent; if they do whet the appetite, they are injurious just in proportion as they do it; it is fighting against Nature; for, while she is endeavoring to moderate our desire for eating, we are trying to increase it; she aims to diminish the amount of fuel to supply the internal furnace; we try to increase it. In fact she goes further and absolutely changes the appetite. In February we revel on pork and fat and sweets and buckwheat cakes and corn bread, which are almost wholly "carbon;" we all know them to be "heating;" and as spring comes on, we relish "greens" and spinage, the early vegetables and fruits and berries, which we all know to be "cooling" with their delicious acidities. How we delight in cabbages and turnip tops, and other green things which are eaten with vinegar, and turn away from pastries and puddings and doughnuts, and other forms of fats and sweets!

If, in the spring, we eat with the appetite of winter, or goad ourselves to it with tonics, the inevitable result in all cases, infallibly, is that there is too much internal heat, meaning fever, followed by biliousness with its long catalogue of "ails," ending in dysenteries, diarrhœas and insufferable debilities.

Families make a great mistake, especially in the country, in early dispensing with fires. Where there are children there should be a good blazing fire on the hearth, at least in one room in the house, all day, until the first of May, and during May until after breakfast, to be kindled up at sundown. The instinct of the children will drive them to that room, and when they cease to gather around that fire, mornings and evenings, then, and not till then, ought fires to cease for the summer.

CHANGING CLOTHING.

Health and sometimes life itself is often lost by laying aside winter clothing too early. Laying flannels aside in the spring is a most pernicious practice. They are as necessary in July as in January. We can better do without woolens next the skin in midwinter than in midsummer. We do not get overheated in winter; we do in summer; and the most frequent exciting cause of coughs, colds, and consumption is a rapid falling of the temperature of the body. All are familiar with the fact that a sudden checking of perspiration is always dangerous; very little exercise causes us to perspire in summer, and a very slight draft of air checks the perspiration; hence, eminent French physicians have stated, after a long series of observations, that colds taken in summer excite the most incurable forms of consumption. White woolen flannel is a most efficient guard against these sudden changes, because it keeps the heat of the body in, while it repels the excessive heat from without; it conveys the water of perspiration to its outside, while the surface next the skin is drier. We all known that silk, cotton, and linen next the skin get saturated with water, and if, for an instant, the slightest draft of air gets between the skin and the material, there is a charnel-like chill when that material touches the skin.

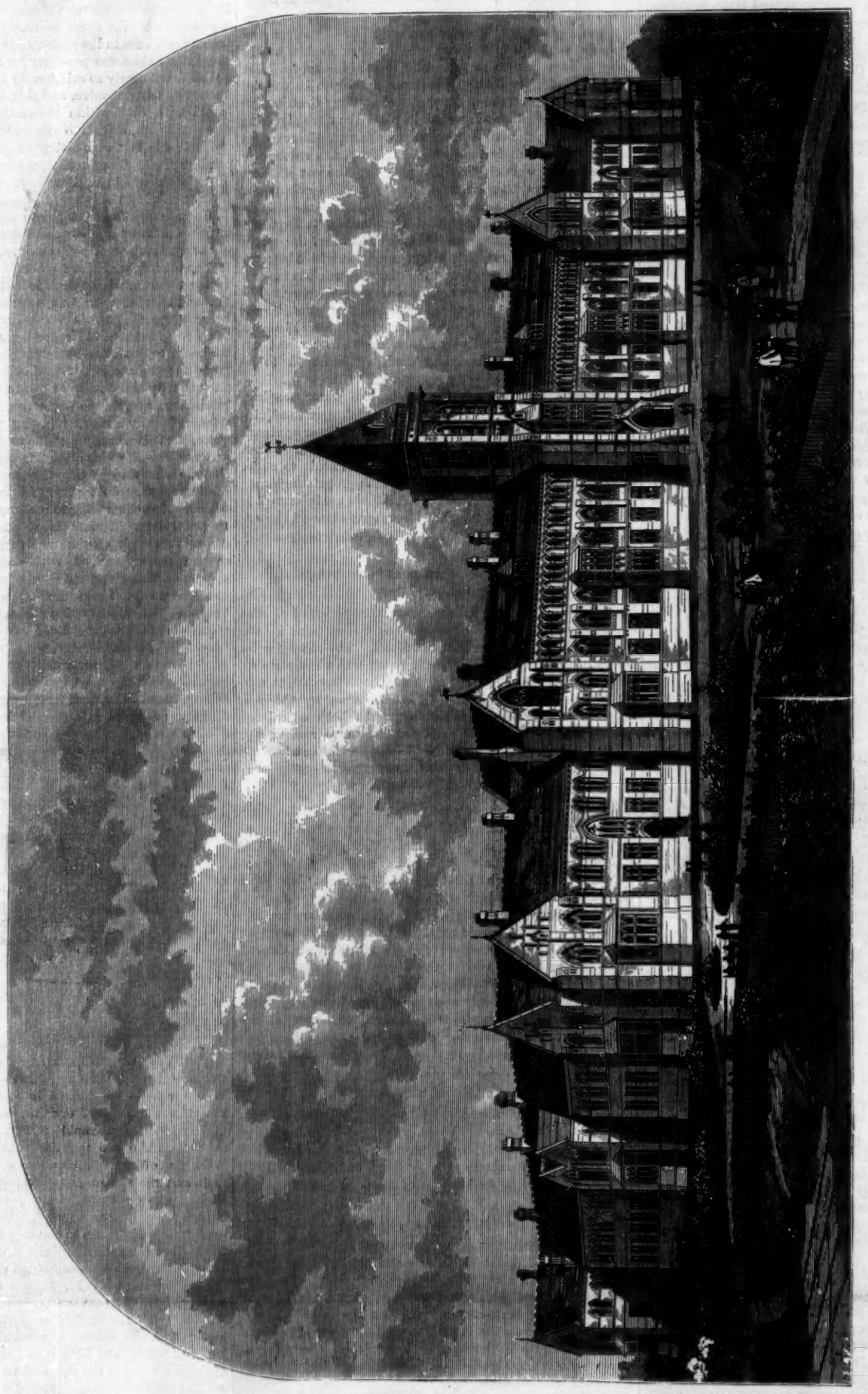
The rule should be to wear white woolen flannel next the skin all the year round; thick in winter, a little thinner in April, a gauze material on the first day of July; on the first of October resume what was laid aside in July; on the first of December put on the thickest, extending to ankles and wrists.

These rules of change are especially necessary to all old people, to all invalids and young children; day laborers and all out-door workers would be incalculably benefited by the same observances.

THE velocity of light is 192,000 miles per second, nearly. The velocity of frictional or static electricity over a copper wire is 288,000 miles per second. The velocity of sound in water is 4,900 feet per second.

LUNATIC ASYLUM, WINDSOR, ENGLAND.

The fine architectural design, presented herewith, is from the proposed plan for a very extensive lunatic asylum, to be erected at St. Ann's Heath, Virginia Water, Windsor, England. The material for construction is brick with stone decorations, though the latter will be few, the object being to give the edifice a thoroughly brick expression. Portions which cannot be executed in brick will be produced from terra cotta or Ransome's patent stone. Very little ornament will be used on account of the expense of stone carving, and from the fact that the design calls for simplicity without imposing display. The architect is Mr. Alfred Smith.



LUNATIC ASYLUM AT ST. ANN'S HEATH, WINDSOR, ENGLAND.

Another retreat for the insane, we learn, is to be shortly erected at Glasgow, Scotland. The building is to be a model of its class, to cost $300,000, and will be surrounded with some 170 acres of exercising and pleasure grounds. It may be noted in the present connection as an interesting fact that the largest as well as the greatest proportionate number of insane asylums in the United States are located in New England. Massachusetts alone has three State institutions—one of great extent at Worcester, another at Northampton, and a third at Taunton—besides many private retreats conducted by eminent members of the medical profession.

Sleeping Cars in France.

The well known French firm of Desouches, David & Co., Pantin, near Paris, are about to become the exponents of a new system of carriage construction for long through transit by rail, based upon that which has for some years been in operation in this country. The cars, now being prepared, are built upon the model of the Eastern of France railway carriages, being intended for the through route from Paris to Vienna, during the Universal Exhibition at the latter city. They will belong to a private company, and be provided with special attendants, apart from the railway companies' officials. Each carriage is intended for twelve passengers only, that being the number of beds made up. Sanitary, lavatory, and toilet compartments and appliances are to be provided; and one of the three compartments into which the car is divided is to be devoted to ladies, or separate traveling parties, as may be required. The cars will, it is understood, be heated by *briquettes* (artificial burning compound) on the German system, and a certain limited provision for refreshments will be made.

Steel Car Wheels.

An improvement recently patented in England, by Hadfield of Sheffield, and described in *Iron*, is as follows:

An ordinary rolled crucible or Bessemer steel, iron, or other tyre, is heated as hot as possible (without burning), in a suitable furnace, and then placed in a casting box, the nave being first placed in the center and moulded thereto in the ordinary way. Molten crucible steel, or iron, or other metal, is then poured therein, whereby it becomes united together in one solid or hollow homogeneous weldless wheel, thus obtaining a combined wheel of great strength, elasticity and tenacity, free from the defects and liability to breakage of those in ordinary use. The wheel is afterwards annealed, if required.

For wheels of a similar construction to those at present in ordinary use upon railways, the tyre is first suitably heated and placed in the casting box, and then the nave placed in the center. Pieces of crucible or Bessemer steel, or wrought iron, of the necessary thickness, cut into suitable lengths to form the arms or spokes, are arranged around, and retained in their position by molding in the ordinary manner. Molten steel, iron, or metal, is then poured in or otherwise introduced, until they become united into and form one solid homogeneous weldless steel or metal wheel. These wheels are said to be peculiarly free from jarring and concussion, as well as more economical than ordinary wheels, and they are not so liable to sudden expansion or contraction. The absence of complicated tyre fastenings is another very advantageous feature.

PROFESSOR JAMES DEWAR has made a series of experiments by which he has ascertained that the boiling point of carbon is 18,032° Fah.

The Artificial Formation of Organic Substances.

By Dr. Henry E. Armstrong, F.C.S., Professor of Chemistry, London Institution: From marsh gas or methane, by series of operations similar to those whereby ethane is converted into ethylic alcohol, an alcohol is obtained which proves to be identical with methylic alcohol, or wood spirit, one of the main products of the destructive distillation of wood. These alcohols serve as the starting points for the preparation of other hydrocarbons and alcohols bearing relations to each other, similar to those which obtain between methane and ethane, and between methylic and ethylic alcohols. Many of the alcohols, as prepared artificially, are identical with the alcohols which are obtained, together with ordinary alcohol, by fermenting saccharine substances, or which exist in the form of compound ethers in the ethereal oils extracted from various plants.

A long series of products is obtained by the oxidation of alcohol. This is first deprived of a portion of its hydrogen and converted into aldehyde, which latter is then converted by direct assumption of oxygen into an acid: ethylic alcohol, yielding acetic acid, the acid of vinegar. The other terms of the series of alcohols to which ordinary alcohol belongs are acted upon in like manner, and thus a series of aldehydes and acids is obtained. Many of these acids are identical with those which enter into the composition of the natural fats. The aldehydes are extremely alterable compounds, and readily undergo change, almost spontaneously, in fact, being converted into bodies of more complex composition.

Formic aldehyde, the aldehyde of methylic alcohol, is probably formed in plants from the carbon and oxygen of the carbonic acid of the atmosphere (whence, as is well known, plants derive their carbon), and the hydrogen from water. One of the simplest transformations of formic aldehyde is its conversion into sugar; this conversion, however, has not yet been effected artificially, although formic aldehyde has been converted into a substance closely resembling the natural sugars. The aldehydes combine directly with ammonia, and the products readily part with the elements of water, and are converted into alkaloids, one of which, that obtained from butyric aldehyde, is identical in nearly all respects with conine, the poisonous alkaloid of hemlock.

A variety of interesting derivatives is also obtained from the acids of the acetic series, such as glycocine, leucine, glycollic and lactic acids, all of which are substances found in various mineral fluids.—*Iron*.

DETERMINING THE VALUE OF ANILINE COLORS.—The *Chronique de l'Industrie* describes a new method, the principle of which consists in the fixing of the coloring matter to be tested on a plate of glass, by means of collodion. The thin film thus obtained is compared with another of the typical coloring material prepared in the same manner.

SULKY PLOW.

This invention combines a number of useful and ingenious devices by which the plow may be elevated or depressed to furrow at any depth, and the land wheel raised or lowered in connection therewith by simply touching a lever, the actuating power being supplied by the advance of the machine. Other mechanism is provided, through which the plow may be adjusted by hand without altering the position of either frame or wheels.

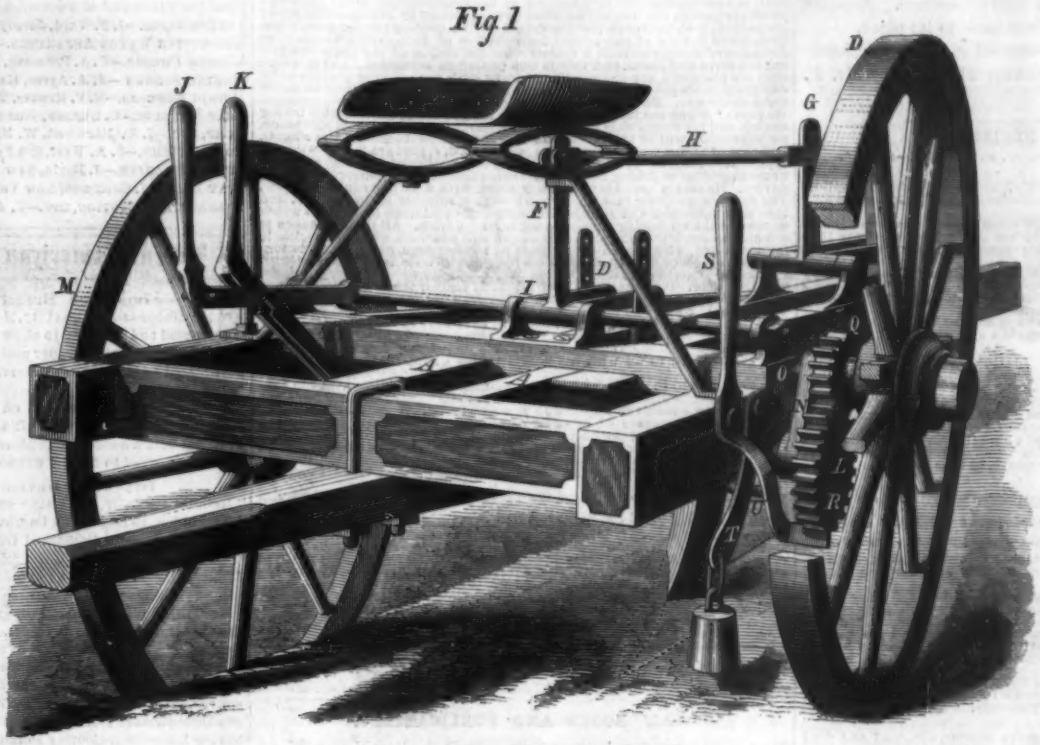
Fig. 1 gives a general perspective view of the apparatus, and Fig. 2, to which we shall first refer, shows the appliances governing the plow. The frame of the machine is clearly indicated in Fig. 1, and a portion of it is represented in Fig. 2, at A. B is the plow beam, the draft upon which is sustained by rods, C, secured to the rear end and also to the main frame. There are four of these rods, of which the inner two extend directly forward while the outer ones are inclined outward so as to serve as braces. To either side of each end of the beam, B, are secured straps, D and E, which pass up between the two parts of the frame—one portion of which is removed in our engraving. In the upper ends of these straps are formed holes, by means of which the straps are pivoted to the arms of bent levers, F and G. The object of the several holes is to enable the plow to be conveniently adjusted to work at any desired depth. By referring to Fig. 1, it will be noticed that these bent levers have each two rearwardly projecting and one upwardly projecting arms. The former are connected, as above stated, to the straps; the latter enter the slotted ends of a rod, H. The pivot pin of the vertical arm of the lever, G, works in a short slot in the rear extremity of the bar, H, in order that the forward end of the plow beam, B, may begin its upward or downward movement in advance of the rear end, to cause the plow to leave or enter the ground more more readily. The lever, G, is simply pivoted at its angle to a suitable support; the lever, F, however, is secured to a cross bar, I, which works in bearings on the frame of the machine. To this bar, and near its end toward the plowed land side of the implement, is attached a lever, J, which is provided, as shown, with a handle placed within easy reach of the driver. By this means it is clear that the plow can be raised or lowered at will without calling into play the devices below described. Referring now to Fig. 1, the arm of the lever, J, is seen passing through the slot of a connecting link, K, and is supplied with a pin which enters a short slot in said link; so that the lever and link may be locked together, and the former operated by the movement of the latter. A notch in the link allows of the detaching of the two portions whenever it is desired to raise or lower the plow by hand, as above described. The link, K, is prolonged by an arm which is secured to the axle, L, and which works in bearings attached to the frame. This is not shown in Fig. 1, being necessarily obscured by other portions. M is the furrow wheel which revolves upon a journal on the axle. To the opposite end of the latter is secured a crank arm, N, at the end of which is a spindle, O, on which the land wheel, P, rotates. To the hub of this wheel is attached a small gear wheel, Q, the teeth of which engage with those of a larger wheel, R, that revolves upon a journal on the extremity of the axle outside the crank arm. S is a lever pivoted to the frame and provided with a handle convenient to the driver. The lever is made with an outward bend, and an offset or foot which, engaging with the teeth of the wheel, R, serves to hold the latter stationary.

When the crank arm, N, is in a vertical position, as shown, the land wheel, P, will be raised, while the other wheel runs in the furrow; and when the arm is turned horizontal, the former wheel will be lowered so that both wheels will be on a level. To secure the latter effect, the driver pushes the lever, S, forward so that its offset catches the gear wheel, R. This wheel being held immovable—the machine meanwhile advancing—the small wheel, Q, must necessarily roll around it, and thus bring the crank arm, N, to a horizontal position. To retain the arm thus, a catch, T, pivoted at its upper extremity and supporting a weight is made at its upper end with a projection which is rounded off above but square below. When the crank arm turns forward the inwardly extending end of the spindle, O, strikes against this projection, which is thus shoved aside, but is immediately carried back by the weight, thus locking the crank arm in place, and permitting the disengagement of the lever, S. On the lower part of the last mentioned portion is a stop, U, which takes against the rear part of the catch, T. When it is desired to return the crank arm, N, to a vertical position, and raise the land wheel—by moving the upper end of the lever, S, to the rear, this stop pushes forward the catch, T, and releases the arm when the weight of the frame, etc., lowers the opposite end of the machine—and the arm becomes upright. The crank arm and lever or link, K, being both rigidly connected to the axle, as the former moves to raise or lower the wheel, through the medium of the link, the plow beam and plow are also raised or lowered at the same time. A suitable stop is provided which prevents the crank arm from being carried backwards beyond a vertical position.

The other portions of the device need no especial reference. The mechanism is not complicated and appears of a strong and durable nature, while the advantages offered as detailed above will, we do not doubt, favorably commend the machine to the notice of agriculturists.

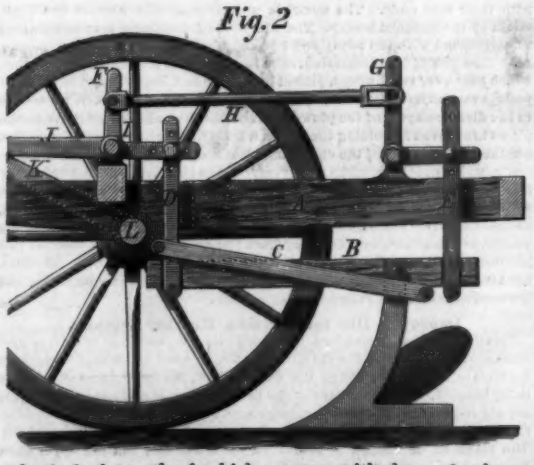
Patented through the Scientific American Patent Agency, March 11, 1873. For any further particulars required, address the inventor, Mr. Louis Sachse, Monmouth, Polk county, Oregon. [See advertisement on another page.]

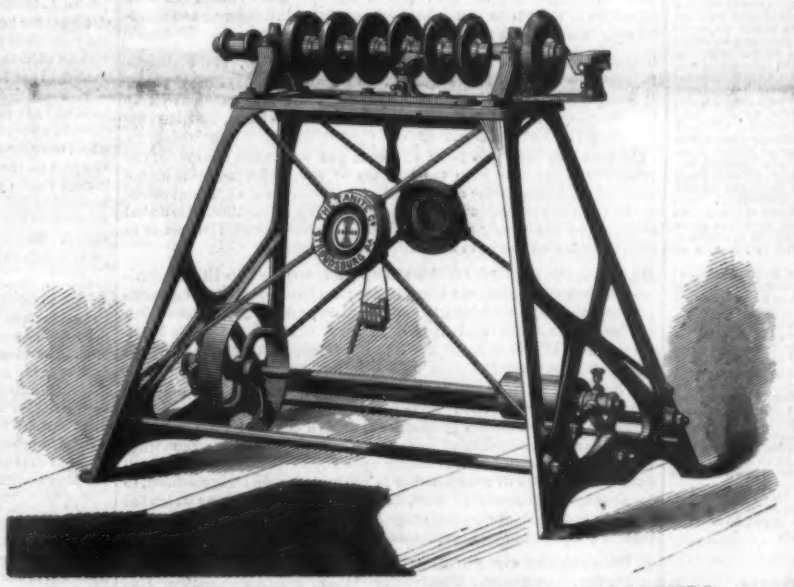
Fig. 1



SACHSE'S SULKY PLOW.

Fig. 2





THE TANITE COMPANY'S SHAPER AND SHARPENER.

Professor Tyndall at Home.

At a recent meeting of the Royal Institution of Great Britain, it was resolved that the warmest congratulations of the members be offered to their Professor of Natural Philosophy upon his arrival in England from the United States of America, in which, upon the invitation of the most eminent scientific men of America, he has been recently delivering a series of lectures unexampled for the interest they have created in that country, and the large and distinguished audiences who have been attracted to them. The members of the Royal Institution rejoice that the people of America have shared in the advantages of Professor Tyndall's teaching and illustrations of those sciences which have been so greatly advanced by the labors of his predecessors, and by his own, in the laboratories of the Royal Institution. They receive and welcome him, on his return to what they are proud to be able to designate as his own scientific home, with satisfaction and delight, and wish him all continued health and prosperity. The members of the Royal Institution have also to thank Professor Tyndall for his liberal gift to the Institution of the splendid and extensive apparatus employed by him in his lectures in America, and congratulate him on the generous spirit and the love of science which has led him to appropriate the profits of his lectures in the United States to the establishment of a fund to assist the scientific studies of young Americans in Europe.

The resolution was unanimously carried.

THE TANITE COMPANY'S SHAPER AND SHARPENER.

The annexed engraving represents a machine especially designed for use in wood working establishments. It is arranged to run six wheels between journals and one overhung wheel, the latter being especially intended for sharpening or gumming saws. The rest shown in front of the wheel can be adjusted on a line parallel with the arbor on either side of the table. It can also be supported across the trough in the bed of the table, thus allowing it to come between the emery wheels. The rest shown at the end of the machine outside of the overhung wheel has finished surfaces, and can be easily set so as to allow the grinding of a bevel at any desired angle. The arbor is of steel, one inch in diameter between bearings, arranged to carry wheels from one fourth to one and a half inches face, movable collars being supplied for this purpose. Wheels as large as eight inches in diameter can be used if desired. The water or oil trough being cast into the bed of the table is not liable to injury from rust or misplacement, and can be emptied by removing a plug, the handle of which is shown underneath the table. The base of the machine is four feet by two feet six inches, and the distance to the center of the arbor is but about three feet. The apparatus stands very firmly and is well and strongly braced. The countershaft is here shown underneath the table, as it is usually preferred; but it can easily be placed on hangers above. While especially designed for shaping and sharpening molding bits, cutters, saws, and other wood working tools, yet the machine can be applied to a variety of purposes by workers on metal. For further particulars address the Tanite Co., Stroudsburg, Pa.

POSTAGE STAMP AFFIXER.

The convenience of the device represented in our engraving will, we think, be at once recognized by all who have ever had occasion to affix the postage stamps to large quantities of mail matter. It consists of an ordinary spring hand press-

er, as shown, beneath which is a small box in which the stamps are placed, pasted sides up. Within this receptacle is a plate supported by a fixed standard, which passes through an aperture in the bottom. When the box is pushed down to the presser, the stamps do not follow its motion.

The letter is first moistened at the place on which the stamp is to be stuck, by pushing it between the roller and dampened sponge. Then it is laid above the box and the presser is brought down upon it. The case is thus forced downwards, and the letter carried in contact with the uppermost stamp, which adheres to the wetted surface. A coiled spring on the standard raises the box back to its place.

This ingenious invention was patented through the Scientific American Patent Agency, January 21, 1873, by Mr. E. B. Morgan, of Paterson, N. J.

PATENT OFFICE DECISIONS.

IMPROVEMENT IN SUSPENDER STRAPS.—J. W. WATTLES.—APPEAL.

LEGGETT, *Commissioner:*

An amendment should not be received which introduces into the application a feature not described in the specification as originally filed, and which has not been sworn to by the inventor.

There is no novelty in making a suspender strap by uniting several layers of a fabric which is well known although it has never been used for that purpose before, if such straps have been previously made from other similar fabrics in the same way.

To claim a production as "a new article of manufacture" does not entitle it to a more favorable consideration.

In order to render an article of manufacture patentable, it should require invention to produce it just as much as a machine.

If any one has the right to use a certain fabric he is not to be restricted in his right by a patent for employing the fabric in a way which did not require invention.

IMPROVEMENT IN SKATE FASTENINGS.—REHR & MONGEL, ADM.—EXTENSION.

LEGGETT, *Commissioner:*

The extension of a patent refused because the application was sustained only by the affidavits of the petitioners, and also because the invention was never in extensive use, and the demand for it had ceased.

It is a grave objection to the extension of a patent if an interest in it has been assigned upon the purchaser's agreeing to employ counsel, and, if it can be made to cover subsequent improvements, to take measures for that purpose.

DECISIONS OF THE COURTS.

United States Circuit Court---District of New Jersey.

SAWING MACHINE PATENT.—E. S. EMERSON *et al.*, *vs.* EDWARD SIMM *et al.*

This was a suit in equity under letters patent granted to Robert G. Emerson and John Myers, under date of May 23, 1854, for an improved sawing machine.

It appeared that the defendants, without knowledge of the patent, had purchased a single machine which was acknowledged to be an infringement of complainants' patent; and, further, that when they were notified that they were infringing they promptly abandoned the use of all the devices protected by the patent. It also appeared that the complainants had an established license fee for persons of the class of the defendants for using machines made under the patent.

The case came up upon exceptions to the master's report, to whom it had been referred to state an account of the profits received by the defendants and to assess the damages suffered by the plaintiffs.

NIXON, *Judge.*

I have examined the testimony taken by the master, returned and filed with his report, upon which he bases his award of $1,200 for damages to the complainants. It appears that the defendants purchased the machine in the open market, without a knowledge of the patent; that they used it about nine months, commencing in September, 1870, and ending in June, 1871; that it was used solely in their own business in sawing boards for the manufacture of trunks, and that they abandoned all the patented appliances to the machine when notified of their infringement, and before the suit was commenced. No case is therefore made for exemplary damages, and the sole question is whether the amount fixed by the complainants for a license fee to be paid by persons engaged in business of the character carried on by the defendants is a fair criterion by which to judge of and measure the damages suffered by complainants from the defendants' infringement.

The courts have always found it difficult to lay down any precise rule of damages in patent cases. The legislation of Congress in the matter is quite suggestive. By the 8th section of the act of 1793, if any person made or used an invention without the consent of the patentee he forfeited and became liable to pay to the patentee a sum that should be at least equal to three times the price for which the patentee had usually sold or licensed to other persons, the use of the said invention. This was found in actual practice to be a measure of damages both inconvenient and harsh; inconvenient, because it did not make provision for those cases where the patentee manufactured and sold his invention and depended upon the profits thus realized for his remuneration; and harsh, because it did not allow any discrimination to be made between the innocent violator and the willful pirate. The 14th section of the act of July 4, 1836, before referred to, restricted the jury to actual damages, but allowed the court in its discretion to treble the amount, according to the circumstances of the particular case. This section has been re-enacted in the law of July 8, 1870, and, in addition thereto, authority has been conferred upon the court, sitting in equity, to ascertain and assess, not only the profits of the infringer, but the damages of the inventor, with power of a corresponding increase in its discretion. But, although no rule can be laid down applicable to all cases, there is one which ordinarily applies to cases of this sort, where the patentee depends upon license fees or royalties for his compensation for the use of his invention. If he has an established license fee, the amount of such fee is his loss or damage for the use of the invention without a license.

The Supreme Court, in Seymour *et al. vs.* McCormick, 16 How., 480, says: "Where an inventor finds it profitable to exercise his monopoly by selling licenses to make or use his improvement, he has himself fixed the average of his actual damages, when his invention has been used without his license." The same rule was applied in Sickles *vs.* Borden, 2 Blatch. C. C., 543; in Goodyear *vs.* Bishop, 2 Fish., 160: and in Spaulding *vs.* Page, 4 Fish., 641.

The defendants seek to avoid the application of this rule in the present case by showing that they ceased to use the complainants' invention when apprised of the patent, and substituted other appliances which render the machine quite as effective and useful for their purposes. I do not now listen to the suggestion of complainants' counsel that these substituted appliances are mere mechanical equivalents, for this is not the proper time and mode of trying that question; but, surely, the defendants are not permitted to get rid of the consequences of a confessed infringement by alleging that they might have used some other machine as advantageously as the complainants'. However available such proof might be in considering the question of the defendants' profits, it has no weight in measuring the complainants' damages.

I am, therefore, of the opinion that the exceptions must be overruled and the master's report confirmed, and it is ordered accordingly.

Such decree in this case will give to the defendants the right to use the invention of the complainants during the life of the patent.

F. H. Betts, for complainants.
B. J. Glassey, for defendants.

Supreme Court of the United States.

DENTAL VULCANITE PATENT.—BENONI R. GARDNER, APPELLANT, *vs.* THE GOODYEAR DENTAL VULCANITE COMPANY *et al.*

[Appeal from the Circuit Court of the United States for the District of Rhode Island.]

Mr. Chief Justice Chase delivered the opinion of the court:

The original suit in equity was brought by the Goodyear Dental Vulcanite Company against Gardner to enjoin him from the use of certain patented subjects belonging, as alleged, to the company, and for an account. The case was heard upon a bill, answer, and testimony, and there was a decree in favor of the company in the Circuit Court for the District of Rhode Island in September, 1870. Upon appeal to this court the decree below was affirmed on the 6th of May, 1872, but the opinion has not been read.

The defense was conducted by counsel originally employed and paid by Newbrough, under whom Gardner was licensee. On the 1st of July, 1869, before the decree in the circuit court, Newbrough and the company compromised all matters of difference between them, with the understanding that this suit should go on to the final hearing and determination, both in the circuit court and in this court on appeal, as if the compromise had not been made.

The company, however, paid the counsel employed for the defense as well as for themselves in the circuit court, and subsequently in this court.

These facts appear from the record and from the admissions of the company in the ninth article of their answer to the motion to dismiss the appeal. They are the only facts which we think it necessary to notice.

It may be that the company has not become the legal or equitable owners of the opposing interests involved in the suit. There may be, and doubtless are, large opposing interests of which they are neither the legal nor equitable owners. But it cannot be admitted that one party to a suit can pay the fees of counsel on both sides, both in the court below and on appeal, without being held to have such control over both the preparation and argument of the cause as to make the suit merely collusive in both courts. It can make no difference that the counsel fees were charged to the party, apparently though not really liable to pay them, and payment from the other party procured through him. This, indeed, is a circumstance against the party who pays the fees rather than in his favor.

The motion to vacate the decree of affirmance heretofore made, and to dismiss the appeal, must, therefore, be granted, and an order made to recall the mandate which has been issued to the circuit court. We take occasion, however, to say that we see nothing in the conduct of the counsel who actually represented the company which merits blame or which ought to affect in any degree the high esteem in which they have been held. Neither of them appears to have had any knowledge of any arrangements made by their clients with the opposing party.

United States Circuit Court---Southern District of New York.

HAND STAMP PATENT.—THOMAS I. W. ROBERTSON *vs.* JOHN GARRETT AND MICHAEL HOLIHAN.

BLATCHFORD, *Judge:*

The letters patent sued on this case, being reissued letters patent granted to the plaintiff, December 12, 1871, for an "improvement in hand stamps," the original letters patent having been granted to him, September 22, 1857, and extended for seven years from the 22d of September, 1871, are the same that were involved in the suit of the same plaintiff against the Secombe Manufacturing Company in this Court. The only defences set up in this Court, in the answer in this suit, are that letters patent for inventions embracing substantially the same devices and combinations that are described in the plaintiff's patent, were granted in Europe to three different persons at dates prior to the date of the plaintiff's patent; and that the plaintiff's invention is of no use, and has never been introduced into public use, and the combination of devices described in his patent has never been and cannot be successfully used as a hand printing and dating stamp, or for any of the purposes set forth in his patent.

No evidence as to the European patents referred to has been put in.

To say that the plaintiff's invention is of no use, and that the combination of devices described in his patent has never been, and cannot be, successfully used as a hand printing and dating stamp, or for any of the purposes set forth in his patent, when it appears that the defendants have made and sold large numbers of stamps containing the inventions set forth in the claims of the plaintiff's patents, and have introduced them into use, and that, in such stamps, the combination of devices described in the plaintiff's patent is used in the manner directed by the plaintiff in the specification of his patent, is to overlook the true state of the evidence in the case, when considered in view of the proper construction of such specification. The defendants' stamps contain precisely what the claims of the plaintiff's patent set forth and claim, and this is not denied in argument. Yet it is said that the plaintiff's apparatus will not work with such inking process as he describes in his patent, and will only work with such an inking ribbon as the defendants use. But the plaintiff describes no particular inking process. He says: "When the face of the stamp is inked over by any suitable inking device, and the stamp duly pressed upon a letter or other suitable substance, an impression will be left thereupon of the types contained in the ring, C, and also of those types of the type wheels, *c*, *d*, *e*, that are in line with the types in the ring, C." He does not show, by description or drawing, any form or arrangement of inking device. His invention does not concern an inking device. He states that his stamp will work with a suitable inking device. The defendants show that it will work with a suitable inking device, and that they make and sell stamps containing the plaintiff's inventions which do work with an inking ribbon as an inking device. All their evidence is directed to show that the plaintiff's stamp will not work with an unsuitable inking device, which is, in effect, what he himself says, in his specification, and such evidence clearly shows that the plaintiff's stamp, when used with an inking ribbon, as a suitable inking device, will do what the specification says it will do. It is, therefore, useful. It is shown that an inking ribbon, as an inking device, was well known at the date of the plaintiff's patent—so was an inking pad and an inking roller. Any one of them falls under the head of a suitable inking device, referred to in the specification. One may give less trouble than another. The pad may require care to be used in keeping the type wheels clean, where the stamp is frequently used. But all this has nothing to do with the completeness of the invention, in a legal sense.

So in regard to the use of a guide or plunger in connection with the handle. The specification says that the stamp is to be "duly pressed" upon the substance on which the impression is to be made. It shows no guide or plunger, or any means of pressing or guiding, except that of the hand directed by the skill of the user. The evidence shows that, for some uses, it is desirable not to have a guide or plunger. But a handle in a guide, although the guide may make it more useful for some purposes, is none the less the handle of the plaintiff, carrying the apparatus for the purposes set forth by the plaintiff.

The other objections suggested by the evidence have no force and require no consideration.

The good faith of the defense in this case is more than questionable, in view of the statement, in a circular issued by the defendants, that the arrangement of dates on revolving cylinders was "an improvement which revolutionized the manufacture and use of stamps" by superseding the type setting stamps formerly in use. That improvement is conceded to the plaintiff by the absence of all evidence attacking the novelty of the patent.

There must be a decree for the plaintiff, for a perpetual injunction, and an account of profits, and an ascertainment of damages, with costs.

Frederic H. Betts, for the plaintiff.
James B. Robb, for the defendants.

[The Chamberlain Manufacturing Company, No. 10 Courtlandt Street, New York, and N. L. Chamberlain, Boston, Mass., have, we understand, acquired the exclusive privilege of working this patent.]

NEW BOOKS AND PUBLICATIONS.

THE ROMANCE OF ASTRONOMY. By R. Kalley Miller, M. A., Fellow and Assistant Tutor of St. Peter's College, Cambridge, England. New York: Macmillan & Co., 38 Bleecker Street.

This is a most entertaining and pleasing little volume, the contents of which were originally prepared for delivery in lectures, and were subsequently published in the *Light Blue*, a Cambridge University magazine. The readers of the SCIENTIFIC AMERICAN need not here be told of the wonders of modern astronomical discovery, or of the fascination and absorbing interest with which they are read: and in this book will be found the most attractive of these facts and phenomena, exhibited in a pleasing and graceful style by a thorough and capable scientist.

REPORT ON THE HYDRAULIC LIME OF TEIL, its Fabrication and Use in Construction of Marine Work, Canals, Aqueducts, Sewers, etc. By Leonard F. Beckwith, Civil Engineer, etc. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

The work now before us is an elaborate and exhaustive account of the properties of the lime from the quarries of Teil, which is a place on the banks of the Rhone, in the department of Ardeche, France. The question of the value of hydraulic cements, especially in the preparation of artificial stone, is now one of very great importance; and the material treated of in this report is well known in the United States markets.

MANUAL OF CHEMICAL ANALYSIS, as applied to the Examination of Medicinal Chemicals; a Guide for the Determination of their Identity and Quality, and for the Detection of Impurities and Adulterations. By Frederick Hoffmann, Ph. D. New York: Appleton & Company, 549 & 551 Broadway.

In this book, Dr. Hoffmann has given a most valuable aid to the practical and scientific pharmaceutist. As he states in his preface, the preparation of drugs and *materia medica* generally has passed out of the hands of the retailers and compounders of prescriptions: and the value of a knowledge of tests and reagents becomes doubly apparent when we consider how various are the modes of manipulation in use by manufacturing chemists, to say nothing of the numerous ways, dishonest and otherwise, by which the qualities and effects of chemicals may be altered. Dr. Hoffmann's book is especially directed to these points, and is compendious and complete.

A DICTIONARY OF SCIENCE, comprising Astronomy, Chemistry, Dynamics, Electricity, Heat, Hydrodynamics, Hydrostatics, Light, Magnetism, Mechanics, Meteorology, Pneumatics, Sound and Statics. Preceded by an Essay on the History of the Physical Sciences. Edited by G. F. Rodwell, F. R. A. S., F. C. S. With numerous illustrations. Philadelphia: J. B. Lippincott & Co.

This work is a valuable compendium of scientific knowledge, which has, during the last few years, made such unexampled strides. Among the contributors are Professors Bottomley, Crookes, Guthrie, Proctor, Tomlinson, Wormell, and Rodwell, the work being edited and supervised by the last named scientist, who has also contributed the introductory essay, the articles which may be included under the generic title of "Heat," and many others. As an authoritative text book for the sciences as they are in the present day, this work can hardly be overestimated.

EXPRESSION: ITS ANATOMY AND PHILOSOPHY. By Sir Charles Bell, K.H. With Notes and Illustrations. Price $1.50. New York: S. R. Wells, 389 Broadway.

An acceptable reprint of a well known work. No writer of modern times has more deeply studied the subject of expression in art and nature than Charles Bell; and his writings are not only valuable for the student and the artist, but are enjoyable by every cultivated mind.

A TREATISE ON THE STRENGTH OF BRIDGES AND ROOFS, with Practical Applications and Examples, for the Use of Engineers and Students. By Samuel H. Shreve, A. M., C. E. New York: D. Van Nostrand, 23 Murray Street and 27 Warren Street.

There is no branch of engineering science which is of greater value and interest to the public than bridge-building; and American engineers are justly proud of the many structures which carry our railroads over difficult places. The ingenuity and fertility of resource which American engineers have employed in these works have elicited the applause of the profession in older countries, and have pointed out the American timber bridge as a model of originality and economical construction. The book now before us, which we have not hitherto been able to review at any length, is a complete and detailed treatise on the practice of the best engineers, as shown in the most exemplary specimens of this department of civil engineering. The explanations of the theoretical part of the subject and the calculations are admirably lucid, and are intelligible to the most unlettered reader; and the book is likely to be eminently useful to the student, and to raise the reputation of its author.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 14 to March 20, 1873, inclusive.

ARTIST'S SCRAPER.—H. J. Haight, New York city.
BLASTING.—E. A. L. Roberts, Titusville, Pa.
BOOT PEGS, ETC.—J. B. Winslow, Boston, Mass.
BUILDING MATERIAL.—G. De Witt, J. Fairman.
CASTING STEEL.—W. Dougherty, Philadelphia, Pa.
CLAMP.—W. H. Goodchild, Bayonne, N. J., S. F. Hay, Brooklyn, N. Y.
CURTAIN FIXTURE.—C. Buckley, L. L. Sawyer, Meriden, Conn.
LAYING PIPES.—J. F. Ward, Jersey city, N. J.
LOCOMOTIVE WATER APPARATUS.—W. E. Prall, Washington, D. C.
MAKING CHEESE.—H. A. Freeman, Sherburne, N. Y.
MAKING SCREWS.—J. A. Ayres, Hartford, Conn.
MOSAIC VENEERS.—H. F. Krause, Brooklyn, N. Y.
PEAT MACHINE.—C. Luxton, Hudson city, N. J.
PUMP, ETC.—I. K. Harwood, W. Newcomb, Baltimore, Md.
ROTARY PUMP.—S. A. West, San Francisco, Cal., L. Goodwin, Virginia, Nev
SEWING MACHINE.—J. Boyle, New York city.
STAY BOLT.—J. Cochrane, New York city.
TRANSMITTING MOTION, ETC.—T. A. Weston, Ridgewood, N. J.

Recent American and Foreign Patents.

Improved Breech Loading Fire Arm.

Henry Hoppenau, Kansas City, Mo.—It consists in a spring lifter peculiarly constructed and arranged to allow the slide freedom of movement, while it is itself always kept in proper position for use. It also consists in a slotted post placed on a slide so as to serve as a handle for moving it and as a guide for an adjustable sight. It also consists in a device for retracting the bolt consisting of a slide grooved on the under side and shouldered to act against a lug on top of bolt. It also consists in a bolt or needle carrier provided with a notched side piece by which it may be locked with a screw until it is desired to fire the weapon.

Improved Device for Emptying Stoves.

Bernard Connelly, 100 Duane street, New York city.—This invention has for its object to furnish an improved device by the use of which the ashes and cinders may be discharged from the body of the stove and removed without raising a dust. In the middle part of the bottom of the stove is formed a recess to receive the ashes from the grate. Upon the outer surface of the sides of the recess are cast flanges. The rear end of a plate, when pushed fully in, enters a recess or groove in a flange cast upon the lower edge of the rear end wall of the recess. The forward end of the slide is turned upward, and is so formed as to fit upon a flange cast upon the outer surface of the forward end wall of the recess. To the forward end of the slide is attached a handle, by means of which it may be drawn out and pushed in conveniently. Downwardly projecting flanges are formed upon the bottom at a little distance from the side and rear end walls of the recess, said flanges having inwardly projecting shoulders formed upon their lower edges. A pan is provided, the sides and rear end of which have their upper edges bent outward to fit and rest upon the shoulders of these flanges. With this construction, when the stove is to be emptied, the slide is drawn out and the grate is dumped, the ashes and cinders falling into the pan. The slide is then pushed in, closing the bottom of the stove. The pan may then be detached and emptied whenever desired or convenient, so that the stove may be emptied and the ashes and cinders removed without allowing a particle of dust to escape into the room.

Improved Metronome.

John A. Heckenbach, Mayville, Wis.—This invention relates to a new instrument for keeping the time during musical performances or exercises; and consists in such an arrangement of clock work, and connection thereof with an adjustable index hand, that a suitable number of vibrations of a pendulum can be produced, and from the pendulum a suitable number of strokes on a gong or bell. The pendulum vibrations are regulated by an adjustable slide on the pendulum stem, and serve, by means of cams on the pendulum pivot, to vary the speed of the rotating escapement wheel, which wheel has projecting pins on one side for moving the clapper of the bell. The pins on the escapement wheel are set in circles, with varying numbers in each circle; and the clapper can, by the aforementioned index hand, be brought in line with either one of the circles, so that in a given speed of rotation of the escapement wheel the number of bell strokes can still be varied. This latter adjustment is for the purpose of giving the 6th, 4th, or other subdivisions of measure.

Improved Police Nippers.

John B. Craig and Michael Haughey, St. Louis, Mo.—The invention relates to a policeman's nippers. The handle of this instrument is, by a shank, connected with a sort of box, between which two curved jaws are pivoted by pins. The pivoted ends of the jaws have toothed portions meshing into each other to cause their simultaneous movement in opposite directions. A spring is fitted into the box and bearing against the edge of one jaw. A spring trigger is pivoted within the box and catching into the teeth of the other jaw. When the jaws are open they are ready to be applied to the wrist of a prisoner. As soon as the trigger is touched the spring will force the jaws shut around the prisoner's arm. In this position the lower ends of the jaws become locked together by a spring catch.

Improved Cultivator.

William Willerton, Jacksonville, Ill.—The invention consists in the improvement of cultivators. The wheels revolve upon the journals of short axles; to the rear ends of the plow beams, are attached the standards, upon the lower ends of which are formed seats for the plows, which may be of any desired kind. The plows are connected with each other and held at the proper distance apart by the bar, which is made in the shape of an inverted U, and has arms projecting from its opposite side bars. The arms are secured to the plow standards so that the plows may be readily adjusted further apart or closer together, as may be required. The forward ends of the plow beams have clevices attached to them, which are connected with eyebolts, attached to the lower ends of uprights. The upper ends of the uprights are secured to the front cross bar of the frame so that the forward ends of the plow beams may be adjusted at a distance apart corresponding with their rear ends. The uprights are strengthened against the draft strain by the inclined braces. The rear ends of the braces may be adjusted to correspond with the adjustment of the uprights. To the plow beams near their points of intersection, are attached the lower ends of two chains which pass over two pulleys, placed loosely upon a long keeper, so that the pulleys may adjust themselves further apart or closer together, according to the distance apart of the plows, and so that the pulleys may move as the plows are moved in guiding them. At a little distance in front of the cross bar the forward ends of the chains are attached to the rear end of a single chain, which passes around a pulley, pivoted to the forward cross bar of the frame, and its other end is attached to the forward end of a notched bar, which passes through a keeper, and has a handle formed upon its rear end, so that the driver can adjust the plows to work at any desired depth in the ground or raise them entirely away from the ground as may be desired. To the rear end of the tongue is pivoted the draft box, to the ends of which are attached the rear ends of the draft chains. The seat can be raised and lowered as the hight of the corn may require.

Improved Die for Shaping Hatchet Blanks.

Jonathan Yerkes, Frankford (Philadelphia), Pa., assignor to Yerkes and Plumb, of same place.—The die has, near the forward end where its surface is concave or flat, projecting lips at the sides, the inner faces of said lips being beveled. Where the face of the die is convex or ridge shaped, the lips are not required, as the lateral enlargement of the blank over the rounded ridge is desirable. The upper die is of the same form as the inverted die The blank to be shaped is placed on the lower die, and the upper then brought down. The lips embrace the blank before the surfaces can reach and press it; therefore, the lips prevent all lateral enlargement and serve, in fact, to bevel the corners of the blank, and start the octagonal shape of the hatchet head

Improved Car Coupling.

Melvin C. Doubleday, Sharon, Vt.—The invention consists in an improvement in car couplings. The drawhead consists of an upper plate and a lower plate connected at the outer end by a bumper plate, from which plate they extend back and are fastened so as to remain parallel with each other. The coupling link consists of two bars confined in a reversible box. This box fits between the plates of the drawhead, and is attached thereto by a central pin upon which the box turns. The bars forming the coupling link are placed in the box with their coupling ends projecting from the box and through the bumper plate of the drawhead. To allow the box to be reversed, or turned end for end, with the bars thus arranged, the bumper plate is slotted. Springs confined in the box serve to force the coupling bars together. In one coupling the bars project and form the coupling link; in the other the box is reversed, the coupling bars being turned inward, while the other end of the box receives the link and coupling pin. When the two couplings come together, the ends of the bars enter the spring jaw as they snap around the coupling pin. This jaw prevents the ends of the bars from spreading, and makes the coupling secure. The jaw slides on a rod upon which is a spiral spring. The advantage of making the coupling box reversible is that any two cars may be coupled together. For uncoupling the cars, the pin is withdrawn, while they couple automatically.

Improved Tobacco Pouch.

Daniel Read, New York city.—This invention has for its object to furnish a combined tobacco pouch and wallet; and it consists in the combined tobacco pouch and wallet, composed of the pouch, made of rubber or other suitable waterproof material, and provided with a metallic frame, and the pockets of a wallet arranged upon one or both sides of said pouch.

Improved Machine for Upsetting Tires.

Charles J. Peterson, Brevard Station, N. C.—The object of this invention is to provide means for lessening the diameter of a wheel tire without cutting the tire. The tire to be upset is bent inward on the machine, and then fastened by the keys between serrated jaws; and while hot the bent portion is hammered down flat to the bed plate, thus upsetting it. The tire is afterward dressed upon the anvil and applied to the wheel. The bend in the tire before operating with the machine may be more or less according to the amount of upsetting required.

Improved Mosquito Net Frame.

Nicolai Petersen and Rosa Roescher, of Memphis, Tenn.—The object of this invention is to supply a portable mosquito net frame which may easily be placed in position for use, adjusted to any desired hight, and, after use, be readily folded and stored away. The device consists of a top center piece, composed of two parts hinged together, which may be folded and opened. It supports four diagonal arms, which are laterally movable therein, which again have pivoted to their ends four legs, adjustable to any desired hight by tubes and spring arrangement. A string connects the ends of the arms firmly, and is used also for tying when the frame is folded for storage.

Improved Gig Saddle Tree.

John Bauer, Newark, N. J., assignor to Chas. M. Theberath and Jacob H. Theberath, of same place.—The invention consists in interposing between the skirt and jockey of a saddle a one-piece metallic plate with pendent pins. These pins, passing through the flap at an oblique angle, hold the same in place without further fastening. Therefore it is only necessary on a gaged machine or otherwise to punch the skirt at the places where the pins are to pass through it, which will insure the proper adjustment of the flap. The upper leather or jockey covers a plate and is held in place by the fastening of the top piece or saddle seat and also by the turret fastening. By the use of this the flap can be properly applied by unskilled persons, and a perfect finish will be insured without effort.

Improved Dress Elevator.

Moris Fox, New York city.—This invention relates to a new attachment to ladies' bustles, hoop skirts, or other dress supports, by means of which the dress can be raised to clear it of mud or rain water during bad weather, or during passage over muddy streets or roads, and subsequently lowered at will.

Engraving and Carving Machine.

Thomas W. Minter, 122 Nassau Street, New York city.—This invention relates to improvements on a carving and engraving machine for which letters patent of the United States have been recently granted to the same inventor. The present invention consists, principally, in simplifying the supports for the article under operation, and for the pattern, and the means for adjusting the same. The holders are fitted into a slotted tilting frame so that they can be adjusted any desired distance apart, and combined with a single longitudinal screw that hangs in the tilting frame, for turning them on their axes in equal degree. The invention also consists in connecting the swivel frame of the cutting tool, by rods, with a crank of the feeling pin; so that when one is turned on the vertical pivot, the other will also be turned in equal manner. The invention finally consists in making the vibrating tool and pin holding beam longitudinally as well as vertically adjustable on and with its holder, so that it can be set to all kinds and sizes of work.

Improved Whip Socket.

John W. Coe and Daniel Merritt, Williamsburgh, N. Y.—The invention relates to whip holders which have on the same standard a pair of clasping jaws above and a basket below. The standard has a shoulder and a screw thread formed upon its lower end to adapt it to be screwed into the timber of the carriage frame. Its upper part has a shoulder formed upon it, and has a screw thread formed upon its upper end, to which are attached spring jaws which curve outward and inward to form a recess to receive and hold the whip. A basket is provided to receive the butt of the whip, which is made in the form of the inverted frustum of a hollow cone. In placing the whip in the socket the butt of the whip is placed in the basket and the whip is then pressed into the space or opening between the jaws, which presses a movable jaw back and allows the whip to pass into the recess between the jaws. To remove the whip all that is necessary is to draw it outward, which presses the movable jaw back.

Improved Knitting Machine.

Edouard Taillouis and Ambroise Renevey, St. Just-en-Chaussée, France, assignors to Joseph Freeman, Windsor Locks, Conn.—This invention consists in the improvement of knitting machines. There are two systems, which comprise knitting mechanisms, which, working together, produce plain ribbed work of the ordinary sort; but each may be worked separately to produce plain work, or either the vertical or horizontal needles may be worked alone; and one set may be making plain work while the other set is making fancy work. The mode of working the two sets of needles together for plain ribbed work is similar to the mode of operation in other knitting frames having vertical and horizontal needles, and need not be described; but for working each set separately to produce a separate fabric on each, a separate thread is supplied to each set, the one for the vertical needles being fed through one guide where the horizontal needles will be forced back before they take the thread, thus throwing the horizontal needles out of action at that place where the vertical needles take the thread and form the stitches. But at the next feeder the horizontal needles will take the thread while the vertical needles will be prevented from working so as to throw off their stitches, so that said needles cannot rise high enough for the loops to pass below the latches, and they will be prevented from taking the thread supplied to the horizontal needles by reason of the said thread being fed through an eye which is so far in advance that their hooks pass below a comb before the thread comes within their range. But at this feeder the said horizontal needles will, in this case, be forced backward further than when they are working in connection with the vertical needles, in order to draw in thread enough to form the stitches. This is not necessary when the two sets of needles are working together, because the vertical needles govern the length of the stitches. The separate fabrics can be instantly merged in one by suitable appliances. In this manner double fabric of any length or shape may be made. By other arrangements several changes in the order of working the needles may be effected. Double ribbed work on the vertical needles and plain ribbed work on the horizontal needles may be made at the same time. If, in these operations, threads of different colors be used at the different feeders—say a black one on one feeder and a white one on the other—the result will be a black surface on one side of the work and a white one on the other: but, if the work be pulled or stretched out laterally, a white interior will be seen from the side which shows a black surface and a black interior will be seen from that side which shows a white surface. These double ribbed stitches can either be continued all the time or be alternated from time to time by plain or other work, at will. With the threads of different colors, both vertical and horizontal stripes can be varied at pleasure. The same kinds of work can be produced on both sets of needles, at the same time making the work alike on both sides, whereby it will be reversible at pleasure, or one set may make different kinds of work, while other kinds are made by the other set. In addition to this capacity of the horizontal needles for performing work of the same kind that the vertical needles do, they can make stripes, squares, and many other useful combinations of different stitches.

Improved Machine for Making Plow Irons.

James M. McGinty and Thomas Nolan, Moulton, Texas.—This invention has for its object to furnish an improved machine for forming plow bars. To the driving shaft is attached a segmental cog wheel, the cogs and blank space being so arranged that the bar or plate to be cut will be fed forward the required distance, and then allowed to be stationary while the dies are operating. The teeth of the segmental gear wheel mesh into the teeth of a gear wheel attached to a second shaft that revolves in bearings in the frame, and which by suitable means is connected with the feed rollers. As the bar or plate from which the plow bars are to be cut is fed forward by the rollers, it passes along a table between guides, which keep the said bar or plate in proper position to be operated upon by the dies. The lower or stationary die is secured to the table. The upper or movable die slides up and down, in ways attached to the frame. The dies are so formed as to form two plow bars at each operation. Each die is provided with two punches to form the holes in the plow bar, and with holes to receive the punches of the other die, and which extend out to carry off the plugs. The plow bar is lifted off the punches of the lower die by two pivoted bars, and which are so arranged that they cannot raise the plow bar above the level of the table, so that it may be pushed from the machine by the bar as it is fed forward by the rollers. The plow bar is held while the upper punches are withdrawn by stops, which, when the upper die descends, enter a notch in it. When the die descends the first time after a bar is fed into the machine, it forms the whole of one plow bar and all the second one but separating it from the bar. The second time the die descends it cuts off the second plow bar, wholly forms the third, and forms the fourth all but cutting it from the bar, and so on until the bar is cut up.

Improved Cooking Vessel.

William Y. Thomson, Oyster Bay, N. Y.—This invention has for its object to furnish an improved cooking vessel or boiler. Upon the inner surface of an ordinary cooking boiler, near its upper edge, is formed a flange for the cover to rest upon. To the inner surface of the boiler, upon its opposite sides, are formed projections at such a distance above the flange as to afford space between them for the cover. In the forward part of the cover is formed a number of small holes, through which the liquid contents of the boiler may flow out when the said boiler is tilted. The perforated part of the cover is covered with a flap, the edge of which is so formed as to fit against the inner surface of the boiler, to prevent the escape of steam through the holes. In the edge of the perforated part of the cover are formed notches corresponding in position with stops upon the boiler, so that by turning back the flap and turning the cover around that edge of the cover may be raised, allowing the cover to be detached. In the cover is formed a hole of sufficient size to allow a fork to be inserted through it to "try" the contents of the boiler, whether they be fully cooked. The ordinary bail is pivoted to the boiler in the ordinary manner. Upon one side of the lower part of the boiler are cast two lugs at a little distance apart, which lugs project outward, and incline toward each other. The ends of a small bail, which are bent outward, are passed through holes in the lugs. By this construction, when no weight is upon the bail, the elasticity of the wire forming the bail and the inward inclination of the lugs will hold the bail in an upright position. When weight is thrown upon the bail in tilting the boiler, the elasticity of the wire that forms the bail allows it to work in the lugs as readily as if they were straight.

Improved Bottle Washer.

William Dick, New York city.—This invention has for its object to furnish an improved device for washing bottles, lamp chimneys, globes, etc. A hollow cylinder, the lower end of which is flanged, is attached to a base of sufficient weight to anchor the device in a pan of water. In the bottom of the cylinder are formed openings, which are closed with valves opening upward. A piston fits into the cylinder and has a hole formed in its center and is attached to the lower end of a tube, which passes up through the cover of the cylinder and has a pan attached to its upper end to receive the water from the article being washed, and guide it back into the pan. The tube has holes formed in its upper part to allow the air to pass in and out freely. The lower end of another tube revolves upon a pivot attached to the bottom of the cylinder. Upon the lower larger part of this tube is formed a screw thread of steep pitch, which fits into a screw thread upon the piston, so that the tube may be revolved by the up-and-down movement of the said piston. The upper part of the tube is made smaller and passes up through a hole in the pan. The brush is formed upon the upper end of the tube. In using the device the bottle or other article to be washed is held over the brush, and the first tube and piston are moved up and down by means of the handle, formed upon the pan, revolving the brush. As the piston is raised a vacuum is formed in the lower part of the cylinder, and the atmospheric pressure forces the water in, opening the valve and filling the lower part of said cylinderr. As the piston is forced downward, the valves are closed, and the water is forced up through the second tube, and is discharged against the inner surface of the article to be washed while the said surface is being rubbed by the brush.

Improved Apparatus for Rendering Tallow, etc.

Peter W. Dalton, Jersey City, N. J.—The object of this invention is to provide means for "rendering" tallow and grease, and cooking and drying the fertilizing animal matters left after the tallow or grease has been separated, together with such other animal matters as may be added thereto; and it consists mainly in the means of connecting the tank or inner chamber for containing the substance to be rendered, etc., with an annular steam space surrounding the same, whereby the surplus steam from the tank is discharged into said space, carrying offensive odors with it, and enabling them to be condensed by introduction of water through a suitable pipe.

Improved Washing Machine.

Cyrus Watson, White Cloud, Kansas.—This invention has for its object to improve the construction of that class of washing machines in which the clothes are washed by passing them back and forth between a pair of rollers connected with the box or tub. The bottom of the tub inclines downward from the center toward each end. The lower roller, which is made smooth, and its journals revolve in bearings in blocks, the lower ends of which are notched, to rest upon the angle of the bottom. The blocks are connected and held in positions by cross bars. The upper edges of the cross bars overlap the sides of the lower roller to prevent the clothes from working in beneath it. The upper parts of the blocks are slotted vertically to receive and serve as bearings to the journals of the upper roller, so that the said roller may move up and down to adjust itself to the varying thickness of clothes that may be passing between the rollers. The upper roller is corrugated or fluted, and its journals project, and to one of them is attached the crank by which the machine is operated. Vertical connecting rods are placed in vertical grooves in the sides of the box, and upon their upper ends are formed hooks, which hook over the journals of the upper roller. Upon the lower ends of the rods are formed cross heads to receive the ends of a spring.

Improved Apparatus for Cooling Liquids, etc.

Heinrich Meidinger, Carlsruhe, Germany.—This device is based on the fact that a concentrated solution of salt will, in contact with the proper weight of ice, produce a temperature of 3° Fahrenheit. If, however, an excess of salt is added, the temperature will always be constant—that is, 3°—as long as any ice is left undissolved, because the excess of salt will preserve the solution always in its highest concentration. This apparatus is worked in the following manner: A cylinder is filled with a certain weight of pounded ice, and then a certain volume of concentrated salt solution is poured over it. Then a ring sieve is filled with coarse salt and hung into the cylinder: last, a conical vessel is put through the central opening of the ring sieve and pressed into the floating ice, when the latter will rise up to the rim of the cylinder.

Improved Life-Preserving Float.

Theodore Hosmer, Sandusky, Ohio.—The frame somewhat resembles a horseshoe in form, and is made of wood, in two sections, the inner sides of which are grooved, with the groove filled with cork to make the frame buoyant. It is made, say, three feet wide and four feet long, and about three inches in thickness, with a circular orifice therein to receive the weight of the person using it. Through the opening is a safety belt attached to the frame, which is buckled around the chest of the person, under the arms or around the waist. Loops are provided, by means of which other persons in the water may hold on to the frame and support themselves. In the frame are slots in which are rotating paddles or propellers. The shaft is revolved by means of the levers, which the person in the frame seizes, the shaft being rotated, when he pulls on the levers, by means of ratchet wheels and other mechanism.

Process and Apparatus for Making Carbonate of Soda.

Ernest Solvay, Brussels, Belgium.—This invention consists: In forcing carbonic acid gas, obtained from any convenient source, through a high column of a solution of salt and ammonia, the hight of which always exceeds and is generally several times as large as its greatest width, and so make the liquor descend and the gas ascend mainly in a vertical direction, by which means a very active reaction is obtained, and a complete prevention of the heating of the liquid: The use of a single vessel of considerable hight in proportion to its width, called the "absorber," for treating the solution of salt and ammonia by carbonic acid: The use of plates perforated with small holes and provided with teeth round their circumference in the said absorber, in order to divide the gas as often as practicable: The peculiar form of calotte or globular segment given to these plates: The use of plates provided with one or a few large holes in the said absorber to prevent the mixing of the liquor at the bottom and top of the said absorber: Feeding the liquor into the absorber at about half of its hight, for obtaining the liquor in the upper half of the absorber in a fit state to retain the ammonia carried off by the gas from the lower half of the absorber: The use of a vacuum filter for separating the bicarbonate from the liquid: The drying of the bicarbonate and its conversion into mono-carbonate of soda with the same filter by passing a current of air or other gas through it: The drying apparatus, consisting of a cylinder in which are placed circular shelves with proper openings, and which is provided with shaft arms and scrapers, which cause the drying substance to move from the top to the bottom of the cylinder: The use of hollow shelves heated internally in the said drying apparatus: The drying apparatus, consisting of a hood provided with a central shaft, arms, and scrapers: The regeneration of the ammonia from the liquid from which the bicarbonate has been separated by magnesia or a basic chloride of magnesium, and the subsequent treatment of the liquid thus obtained, by which muriatic acid or chlorine is obtained, and the magnesia, as well as all the salt which has not been converted into bicarbonate, are recovered.

Improved Apparatus for Protecting Grain and Seed.

Jean Methodios Joannides, of Mark Lane, London, England.—This invention has for its object to prevent the mildew and rotting of seed or grain of all kinds, and other things, during the period of being stored on board ships, or in other places; and this by an apparatus so arranged that fresh air is conducted into and about the mass of seed or grain thus stored. The apparatus consists of a perpendicular cylinder of suitable material, with eight or more horizontal pipes of like material, all connected with and branching from the perpendicular cylinder. The said cylinders, both perpendicular and horizontal, are perforated with small holes for the circulation of the air, but so as not to allow of the grain, seeds, or other things passing through. A series of small tubes are placed in the insides of the large ones for the return of the confined air and to keep up the circulation. The apparatus thus formed is placed in the compartment of the ship, or where the grain or seed may be stored, but is not a fixture of the storage chamber. The perpendicular cylinder, projecting above into the open air, has attached to it a funnel-mouthed ventilator fitted with sponges chemically prepared for purifying the air before its admission into the cylinder. Thus fresh air is introduced down the perpendicular into the horizontal perforated cylinders, and, thus distributed, secures the object in view.

Improved Cartridge Made of Fusible Metals, etc.

William Henry Tooth, Brixton, England.—This invention has for its object to furnish metallic cartridges which can be expelled from fire arms with the projectiles without leaving any residue behind to foul the barrels. The invention consists in constructing the cartridges and projectiles or bullets either of one piece, or they may be made of two or more pieces joined together, and for some purposes metallic cases are made to take in the projectiles and powder or explosive composition. In the manufacture of these cartridges, any metal or compound is used which is not corrosive, such as compositions of lead and tin, and any other metallic substance which will fuse or melt at a comparatively low temperature, whereby the destruction of the cartridge is completely effected; or for a cartridge which is itself explosive. In making the body of the same, the metallic substance is employed, with the addition of bismuth, such cartridge to be filled with powder or other explosive composition.

Cigar Bunching Machine.

Henry B. Bunster, 10 Barclay Street, New York city.—This invention has for its object to furnish an improved machine for bunching cigars. The base frame of the machine is a light casting, and is designed to be secured to a table or bench. Upon the forward end of the frame is formed a raised projection in which is formed a T groove to serve as a guide for the tongue or guide bar of the table or top frame and cause it to move back and forth in a straight line. Upon the rear end of the base frame are formed two upwardly projecting lugs, in the upper ends of which are formed screw holes to receive the screws, which serve as centers to the ends of the roller. The top frame moves back and forth between the arms of the base frame, and in its side bars are formed longitudinal slots, through which the roller passes, which roller thus supports the upper part of the machine while moving back and forth. The frame is guided, as it moves back and forth, by the arms, between which it moves, and by the tongue, and has grooves in its sides to fit into the T groove of the projection. At the rear edge of the platform is formed a trough or recess, into which the proper amount of filling for a cigar is packed. In the end parts of the recess are formed holes to allow the dust that may enter said recess to escape. Upon the forward edge of the platform are cast hooks, upon which the bunch is received. The forward end of an apron or strip of cloth, or other suitable material, passes down through a slot in the forward edge of the platform, and is attached to a rod of such a size and length that it cannot be drawn through the said slot, and which is held up against the under side of the platform by an adjustable spring. The other end of the apron or strip passes over the roller and is attached to a rod, to enable it to be lengthened and shortened by turning the rod in one or the other direction to wind said cloth from or upon it. In using the machine, the frame is pushed fully forward, and the slack of the cloth is pressed down into the recess. The binder is then laid upon the cloth upon the platform, with one end or corner extending down into the recess. The proper amount of filling to form the bunch is then placed in the recess and the frame is drawn back. This rolls the bunch over and over in the bight or fold of the cloth, winds the binder around it, and brings it into proper condition to receive the wrapper, which is applied by hand in the ordinary manner.

Improved Lamp.

Frank A. Flanegin, Fagundus City, Pa.—The collars of glass lamps are usually fastened to the body of the lamp by means of plaster of Paris or cement. Collars thus fastened are very apt to get loose, and are consequently rendered useless until repaired. This invention relates to an improvement in the class of lamp collars in which springs are employed to secure the same to lamps, and the improvement consists in the arrangement of a tubular screw and its attached springs with a lamp collar.

Improved Saw Set.

John W. Leslie, Cairo, Ill.—The invention consists in the mode of fastening a saw set to a handle. The saw set attachment, which consists of a short, narrow, but strong plate of metal is firmly attached to the ferrule so as to project from it, radially. It has a notch or slot in the end, at right angles to the handle, suitable for bending the teeth sidewise by the handle when engaged in the notch.

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Notes & Queries

S. C. M. asks how to whiten the red of white ash.

N. H. H. asks how to put a polish on steel after it is filed.

A. C. T. says: Please give me a method of making a japan of superior quality.

C. F. D. asks: What can I put on a copper exhaust steam pipe to make paint stick?

J. H. asks: How can I make the best paste or cement to use in making paper cop tubes?

G. L. F. asks: What color should a mill pick be when cooled, to cut the hardest quality of burr?

J. H. says: Please inform me what will make ink used for ruling machines dry faster than alcohol.

W. L. asks what is the quickest way to season elm hubs, which are bored through first and then rounded up in the lathe.

E. B. C. wants recipes for making red and blue stenciling ink for marking unplaned wood. "I prefer a liquid to dry ink."

W. H. G. asks: Is there any way that mica, used as windows in anthracite coal stoves, can be kept clean and transparent? If so, how?

W. E. says: W. T. B. tells us that he drives a 4½ feet millstone with a 13 inch belt. Will he tell us the size of pulleys and the speed of his belt?

T. N. asks: What can I mix with wood charcoal to make it in a solid mass and still be porous? I want to use it for a filter, for water to drink.

G. W. S. says: Can you inform me what preparation is used for the bright yellow lacquer on brass castings, such as gas fixtures, and how it is made?

E. F. L. asks: How can a varnish, made from resin dissolved in boiling water by means of carbonate of soda, be made insoluble by water after being applied and dried?

S. says: The V of a railroad terminates in solid limestone in the foot of the mountain; its thickness is about 15 feet. I propose to bank up the cut with several car loads of slack coal and refuse coke, which are worthless, and set them on fire. Would that lessen the labor of deepening the cut and to what depth would the stone probably be burnt?

E. C. M. says: A body weighing 5 lbs. descends vertically and draws a weight of 6 lbs. up a plane whose inclination is 45°. How far will the first body descend in ten seconds? [We would like a solution of this problem, relating to accelerating forces, from any reader who may have more leisure than we have to devote to intellectual gymnastics.—ED.]

E. W. H. says: I should like to have the opinions of some of your readers on the following problem, as it may elicit some original ideas. A rigid body A B, is supposed to be without weight and in a state of rest in space, uninfluenced by any external forces. Required the motion imparted by a given force, P, applied at any point as A, supposing there be no resistance of the air. [This is a neat problem in the higher mathematics which we suspect will be respectfully considered by our readers, and of which we shall be pleased to see a concise solution.—ED.

E. B. C. asks: Will iron, that has been boiled in oil, rust?

W. E. says: I wish to run a stone with a belt without the twist, and sometimes I wish to run the rest of the mill without the stone. How can I disconnect in the simplest manner?

M. M. H. asks: How can I preserve or keep meat, such as beef and mutton, sweet and good for table use, for a week, during the summer months? I have a large ice chest, but I find that the meat sometimes sours.

Owing to the illness of one of our editors the replies to several of our correspondents relating to chemical subjects have been delayed, but will shortly be given.

G. McK. says: Of what metals and in what proportions does the enclosed specimen consist? Answer: It is lead with a trace of mercury.

F. W. says: I have an induction coil of sufficient power to give a spark about the eighth of an inch in length, and I wish to know if I can make a gage for determining the number of pounds a person can hold on it; if so, how? How should I proceed to charge a Leyden jar, or a tumbler of water? Answer: A simple method of constructing an electric gage is to connect one end of a silk thread with the iron wire core of the coil, and have the other end wrapped around a small shaft (a darning needle will do) with a pointer, a fine cambric needle, soldered at one end so as to indicate, on a graduated disk, as the iron core is withdrawn; any gage you may use is to be understood as relative, that is, it is not like pounds pressure, supported by steam. Your machine has not quite sufficient power to charge a jar satisfactorily; connect the outside coating of the jar, with one end of the secondary coil, and bring the other end to within an eighth of an inch of the brass knob.

W. C. V. says: I wish to prepare a battery composed of blue vitriol, copper, porous cup and zinc. 1. Will common sheet copper, such as can be had at tin shops, answer the purpose? 2. After the battery is set up, how long will it be before action commences? Answers: 1. Yes. 2. About eight minutes, or as soon as the solution soaks through the porous cup.

E. B. asks: Is there any such thing as a watch that will tell the distance you walk? Answer: Yes. Watches of this kind are to be had in this city for $15.

H. says: I hand you a specimen of a peculiar sand found in Iowa. It lies on a kind of peat and is mixed with it. What is it and can it be used beneficially as an artificial manure; and if so, on what class of soils? Answer: It is calcareous tufa, deposited from water. We do not think it would benefit the soil.

J. H. C. says: I am running an engine (14 x22, driving a 54 inch saw) which requires 96 lbs. of steam to drive it properly, which I think is twice too much, as I have run more than double the amount of machinery with the same boiler, but a different engine. The boiler is 52 inches diameter x 24 feet long, with two 18 inch flues. Engine and boiler are in good order. If we work at a lighter pressure, the steam soon runs down. We have no trouble to make steam with saw dust. The engine is only eight feet from boiler, connected by a three inch pipe, but it works more water in cylinder than I like. There is a plain slide valve, and a steam chest on top of cylinder. She lets on steam just before passing her centers. Answer: Try valve and piston, and see if there is no serious leak past either. Take off valve chest bonnet; see if valve has a little lead on steam side, cuts off at about two thirds and does not close exhaust until stroke is nearly completed. If this examination results in discovery of no fault, see if steam and exhaust passages are not choked by faults in the casting. Is it certain that the boiler is all right? A careful examination of that, and the application of an indicator to the engine would be very certain to detect the fault if in either boiler or engine.

H. D. N. asks our price for replying to a question relating to the use of belting. We reply that the subscription price of the SCIENTIFIC AMERICAN is three dollars per year, paid in advance. We ask no other charge, and we believe that we meet with some success in our effort to give our subscribers more than an equivalent for their money. H. D. N. will find his question answered in the article on "Driving Power of Belts," which will be found in the editorial columns of this issue.

P. P., Jr., says: I contemplate building a small boat to be worked with a screw by hand; and my object is to attain as great a speed as possible. I would like to know what size of screw it would take, and how many blades it should have; and if it would make any difference if the wheel would project below the bottom of the boat. The dimensions of the boat are to be as follows: Length of keel 18 feet, beam 2¼ feet, depth of hold 1¼ feet. Answer: Make the screw as large as possible. There would, in most cases, be found fewer objections to so placing the screw as to project above the water than below the keel. The great objection to the latter plan is the liability to take the ground. We should suppose a screw of 2 feet diameter and 2 feet pitch with either three or four blades would answer, and could be put in.

J. H. H. asks: What is the relative proportion of size of the cylinders of a compound marine engine? 2. I have been informed that there is no way of effectually governing the compound engine, the theory being that the live steam cylinder gives off enough steam to drive the condensing cylinder from 12 to 20 revolutions (the screw being out of water and the engine having only itself to carry) and that it is only after the emergency has passed that the governor begins to act; and then, probably, is the time when the engine requires all the steam it can get. I claim that, by a different arrangement of valves, a compound engine can be made to govern instantly. I have consulted a mechanical engineer on the subject, but although he says he believes there is something in it, yet he does not think that a mere change of position of the component parts of a machine is patentable. What I want to know is this: If I can accomplish a result not before attained, does it matter by what means I accomplish it, in order to make it patentable? Common sense would seem to suggest that, if by simply turning a hitherto useless thing upside down, it could be made of great value, the discoverer of that fact was entitled to profit thereby. Answer: The proportions vary in every individual case. If desirous of obtaining designs, consult some able mechanical engineer who has had some opportunities to learn the proper proportions. A common proportion gives the high pressure cylinder not far from one half the diameter of the larger. 2. We should consider your ideas correct, but can form no idea of the value of the proposed device without seeing it. The problem attacked is certainly a difficult one.

D. H. P. asks: Can sheets of metal, either plain or with numerous apertures left in, 3 feet square or over, and of a thickness of from ·001 to ·003 of an inch be obtained by the electrotype process? If so, what will be the time required in making such a deposit, and what will be the probable cost if copper is employed? Could such a sheet of metal be deposited on paper so as to adhere firmly? Answers: 1. Yes. 2. Ten cells of Daniell's battery, to plate the surface and thickness mentioned, would require about two hours. The cost would depend mainly on quantity; no price could be mentioned without a preliminary trial. 3. By rubbing plumbago into the pores of the paper, thereby making it a conductor, and then plating it with copper, we have no doubt but that the metal will adhere as firmly as you may need. Will not gold or silver leaf paper answer your purpose?

N. C. sends three samples of rock said to be rich in silver and cinnabar. Are they of any value? Answer: The specimens received show no signs of either silver or cinnabar.

L. P. asks: 1. Is the strength of wood impaired when the wood is dried by steam? 2. Does a large wagon axle draw more easily than a small one? Answers: 1. Wood consists of carbon, oxygen and hydrogen, the latter gases being in the proper proportion to form water. When in its ordinary state, wood also contains some uncombined moisture which is removed by drying or seasoning. If the process is carried on, whether by steam or otherwise, at a temperature which is not much above 212° Fahr., the drying takes place without injury to the wood. If the temperature is carried much above the boiling point, however, the wood is charred, losing all its water of combination, and only charcoal is left. If this occurs, even partially, the strength of the timber is impaired. 2. The smaller the axle the easier the draft, provided that the bearing surface does not become too small to allow of proper lubrication, thus inducing "cutting" of those surfaces.

S. P. S. asks: What is the largest diameter of the drivers in use on the English locomotive engines, and also that of the American? Answer: The diameter of the largest drivers generally used in England is six feet. The same size in this country.

T. G. G. asks: Could an engine be constructed with two steam cylinders, one in front of the other, and use the same steam twice, once in each cylinder? For instance, let the piston rod run through one cylinder into the other. Then let the steam in at the front end of rear cylinder, and let it pass out through a pipe to rear end of front cylinder, so as to get power twice from same steam before it passes out. As the steam enters the back end of rear cylinder, let it pass through a pipe to front end of front cylinder, etc. Answer: Our correspondent describes a "compound engine." With cylinders of equal size, no more power would be obtained, per pound of coal consumed, than with one alone. If the second cylinder be made larger than the first, as T. G. G. will find them proportioned on nearly every steamer now built for ocean navigation, expansion will occur and economy will be effected. The subject of compound engines is too extensive to be treated of here. Our correspondent should know that Nature never gives anything without receiving an equivalent. The same power cannot be obtained twice from the same steam under any conditions.

W. S. D. asks: How can I remove plaster of Paris after it has set hard in metal sockets without injuring them? Answer: Calcine the plaster by putting the socket in a hot fire.

S. E. M. says: 1. I would like some advice in regard to a steam blower. We have a 25 horse boiler for steam heating, etc. The boiler sets about 10 feet from the chimney, and a 16 inch pipe connects the boiler and chimney. I put a spiral coil of ¾ inch pipe, with numerous ¼ inch holes opening upward to create or increase the draft; but it does no good. This coil of ¾ inch pipe enters the smoke pipe near the top of the boiler. If a jet were carried into the chimney, would it do any good? 2. Could I use a hydraulic press for making fluid extracts from roots and barks? 3. Do you think it good practice to test a steam boiler by filling it full of water and starting a light fire? I propose to test ours so once in a while, unless there is some good reason why it should not be done. Answers: We should expect a a jet to work better in the chimney. A jet is never as efficient as a blower. 2. We should not expect a press to work as satisfactorily as the usual method of steeping. Steeping first and the use of the press afterward should extract the juices very completely. 3. Boilers are sometimes tested as proposed. We should prefer heating the water to the boiling point nearly and then using the pump. Water heated under a pressure of 100 lbs. per square inch may reach a temperature 126 degrees above its ordinary boiling point. Should rupture occur, scalding hot water and as much steam as this excess of temperature would suffice to form—that is, about one eighth the total weight of water in the boiler—would be set free to do, possibly, no little damage.

F. S. A. says: I send herewith specimens of formations found in the boilers of the steamship R. R. Cuyler. The tubes were covered with these crystals. Can you tell me of what they are composed? The vessel has been in South American waters off the Pacific coast. Answer: The specimen is an unusually large crystal (considering its method of formation) of gypsum or sulphate of lime, and was derived from the water, which must have been exceedingly "hard."

J. C. H. asks: What is the proper name of an acid that will eat itself out of glass bottles? Answer: Hydrofluoric acid will dissolve glass.

W. F. P. sends a specimen of mineral and asks what it is and the value. Answer: It consists of quarts and hornblende: of no use in the arts.

R. M. S. asks in regard to the construction of chimneys, whether or not they should be built larger or smaller at bottom. Answer: We build our chimneys "straight."

J. M. C. says: If I should set a hydraulic ram 100 feet from and 10 feet below the level of my spring, how much of that water can I raise perpendicularly 20 feet above the ram? Answer: Probably about ten per cent.

S. P. S. says to W. E. G. who asked if boiling pickles in a brass kettle renders them injurious to health, and will a brass faucet in a vinegar barrel injure the vinegar: Yes; in both cases acetate of copper is formed. This is a violent poison and many cases are on record of its injurious effects. The manufacturers of the best pickles made boil them in oak tanks by means of a platinum worm. This is not practicable of course in a small way, but they may be cooked in porcelain lined kettles.

S. P. S. says to R., who asked how to dissolve bones to be used as a fertilizer: If you have but a few to dissolve, the best way is to pack them in wood ashes in a hogshead and let them stay there for about a year, keeping them moist. At the end of this time they will all have disappeared except some of the larger knuckles; these may be returned with the next lot. They may also be burned, but this is extremely wasteful. After burning they should be treated with two thirds of their weight of sulphuric acid, in order to convert them into superphosphate. It costs about ten dollars a tun to grind them while green, and requires the aid of powerful machinery.

S. P. S. replies to S., who asked how to make a red stain that will give, when burnished, a bright clear color: Make a strong decoction of logwood and then add a few drops of sulphuric acid. This works well on wood.

A. O. says in reply to M. E. P., who asked what are the best materials for soldering iron and steel, and how are they used: For large and heavy pieces of iron and steel, copper or brass is used. The surfaces to be united are first cleaned off by filing: then they are bound together with steel, and upon the joint a thin strip of sheet copper or brass is laid, or, if necessary, fasten to it with a wire. The part to be soldered is now covered with a paste of clay, free from sand, to the thickness of one inch, the coating being applied to the width of a hand on each side of the piece. It is then laid near a fire, so that the clay may dry slowly. The part to be soldered is then held before the blast, and heated to a white heat, whereby the clay vitrifies. If iron is soldered to iron, the piece must be cooled off in water. In soldering steel to steel, however, the piece is allowed to cool slowly. The semi-vitrified clay is then knocked off, and the surface is cleaned in a proper manner. By following the hints given, it will be found that a durable clean soldering is obtained. If brass instead of copper is used, it is not necessary to heat so strongly; the former method is recommended, therefore, for steel. Articles of iron and steel of medium size are best united with hard or soft brass solder. In both cases the seams are cleanly filed and spread over with the solder and borax, when the soldering seam is heated. Hard brass solder is prepared by melting in a crucible eight parts of brass, and adding one part of previously heated zinc. The crucible is then covered and exposed to a glowing heat for a few minutes, then emptied into a pail of cold water, the water being strongly agitated with a broom. Thus the metal is obtained in small grains or granules. Soft brass solder is obtained by melting together six parts of brass, one of zinc and one of tin. The granulation is carried out as indicated above. Small articles are best soldered with hard or soft silver solder. The former is obtained by mixing equal parts of fine silver and soft brass. In fusing, the mass is covered with borax, and, when cold, the metal is beaten out to a thin sheet, of which a sufficiently large and previously annealed piece is placed with borax upon the seams to be united, and heated. Soft silver solder differs from hard silver solder only in that the former contains one sixteenth of tin, which is added to it during fusion. Very fine articles of iron and steel are soldered with gold, namely, either with pure gold or hard gold solder. The latter can be obtained by fusion of one part gold, two parts silver, and three copper. Fine steel wire can also be soldered with tin, but the work is not very durable. Hard and soft brass solder are used for uniting copper and brass to iron and steel, silver solder for silver, and hard gold solder for gold.

A. O. says, in reply to L. M. L. who asked if limestone could be successfully employed for the production of steam in a furnace suitably constructed for the purpose: Limestone is a carbonate of lime and will not slake unless burned. As burnt lime commands a ready sale, to produce steam from such lime would be about as reasonable as to use China bark as welding powder, when saw dust will do as well. Besides, you could only produce steam of atmospheric pressure.

A. O. says, in reply to I. C. B. who asked if drinking water, standing in a pail, should be covered, to prevent absorption of noxious gases in a room: The absorption of gases by water, unless they are conveyed through it, is very small or almost imperceptible, and hence no precaution need be taken to prevent it. If containing carbonic acid or oxygen, it will be deprived of it and become stale in an open vessel. The cause why water gets spoiled if not running is attributable to organic matter gathering in it.

A. O. says, to J. C., who asked "if milk and coffee produce leather soup," etc: It is about as true that bread and butter, taken together, will make cheese.

A. H. sends a mineral specimen and asks what kind of stone it is. Answer: The mineral you send is iron pyrites or fools' gold—of no value.

W. B McI. sends a mineral specimen and asks what it is. Answer: Iron pyrites or fools' gold. Of no value.

G. W. asks: Is there any thing that will remove lime scales from boilers? I have used many remedies with but little success. The so-called "disincrusting compositions" offered for sale do not help me in the least. Can you suggest anything that will clean my boilers? I am now using pure water. Answer: Scale once deposited can usually be best removed by mechanical means. To prevent deposition, the lime salt must usually be precipitated before the solution reaches the boiler. Heating to the boiling point will cause deposition of the carbonate. Chloride of barium will throw down the sulphate. Look through our back numbers and select for yourself from the many recipes and methods discussed and described therein.

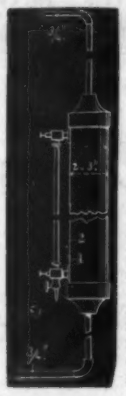
E. G. A. asks: What horse power can I get from a well protected 2½ inch pipe, 75 feet from the boilers, with 40 lbs. of steam? Answer: Judging from our experience, we should suppose that the loss of pressure in such a pipe would not be more than a pound or two. If the boiler can make the steam, this 2½ inch pipe should be sufficient for an engine of 25 or 30 horse power.

W. J. K. says: I have about 300 lbs. of this mineral, and ask you what it is, and is it valuable. Answer: The mineral you send is iron pyrites. Of no special value.

W. F. C. says: I am building a sawmill with 24 feet head, penstock 3 feet x4 inches clear, fed by trunk 20 inches clear x 50 feet long. I have a balance weighing 700 lbs. Shall I attach it to the shaft of the water wheel, which is a flutter wheel with two feet buckets, or use a single crank? Some advise one thing, some another, and I have my own views. The stream is small and I depend on a large dam and high head. Do you think of any other wheel that would answer a better purpose? Some think a balance deadens the quickness of the mill. Will it take more power to run with balance than without? Answer: We should balance the crank by a weight on the opposite side equal to its own, in order to avoid jerking at each center; with a crank thus balanced an extra balance wheel would be of no use. A balance wheel may also be used with a crank (or pitman pin) in one side, with the opposite side loaded equal to the weight of the pitman pin. It is always better to balance a crank, especially in a quick motion. As a principle, a balance wheel is always run at the expense of power which is stored up in the motion of the wheel and more equally distributed, and may be used at any time when periodical force is required, such as for punching, shearing, cutting off sticks of cord wood with a circular saw, etc. There are many turbine water wheels, some advertised in the SCIENTIFIC AMERICAN, that are better than the old fashioned flutter wheel; we would advise sending for the circulars of various makers.

F. A. S. asks in your last number how to make a round hole in a pane of glass without a diamond. My answer is: Shoot it through with a pistol or rifle. There are frequent examples of this mode of perforating glass to be seen among the shop windows of Broadway, New York.—O. D.

A. M. says: "I am running a circular saw mill making 500 revolutions per minute. The saw is 60 inches in diameter, with cast steel mandrel 3½ inches in diameter, running in self oiling Babbitt-lined boxes. The box next to the saw runs hot in spite of all efforts. I use lard oil," etc. Answer: Wet a piece of thin writing paper with oil, and wrap it around the journal on the mandrel (the oil will cause the paper to stick to the journals); let the joint in the paper come on the side of the journal between the boxes; heat the boxes before pouring off; lay the mandrel in, and let it remain until the journal and box are both warm, but not so as to burn or scorch the paper. The mandrel should then be taken out, and the oiled paper stuck around it. Pour the metal around the outside of the paper after the lower boxes are poured; pack between the two boxes with layers of paper, and put on the upper box, bolting it down. After the upper box is poured, take it off and take off the paper, which will leave the journal of the mandrel free to run without heating. As the journals wear down so as to become too loose, take out a layer of paper from between them.



W. T. says, in reply to our correspondent G. M. who stated on page 197 of the current volume of the SCIENTIFIC AMERICAN, that he cannot get his engine room water gage (which is at a considerable distance from his boiler, the connections being made by tortuous pipes) to indicate correctly, as the water will not rise to the level of the water in the boilers, and is, moreover, in constant agitation owing to condensation in the pipe elbows and other obstructions, which he found it difficult, if not impossible, to overcome: Make your engine room gage something like the simple one illustrated in the engraving herewith, and I think you will not have any more trouble by the gage failing to indicate correctly, from the agitation of the water. [A very good and very generally used arrangement.—ED.]

S. T. O. says, in reply to W. H. W., who asked if shrinking tyres on locomotive driving wheels will affect the central hole: I would say that it will, and I learned it 15 years ago. We used to force our wheels on to the axle with a screw with two men at the bar, and afterwards shrink the tyre on; but we never could remove them with any amount of force applied, until we had removed the tyre, then the two men would remove the wheel in the same press easily; these were our heaviest wheels, with very thick hubs. Will some one explain how this can be done with any thickness of hub?

W. R. J. says that G. T. P., can make a good sealing wax by melting together 1 lb. yellow rosin, gum shellac, 4 oz. white turpentine, ½ oz. gum camphor and 2 ozs. vermillion, stirring until cool.

W. R. J. says that G. E. H. has nothing new in his process for tinning cast iron, as he may learn by inquiry at any hardware store. Tin has long been used inside of cast iron tea kettles and boilers.

L. W. E. says that T. W. M. can make tracing paper by melting rosin in turpentine, and varnishing both sides of the paper with the preparation.

G. H. says: I notice your remarks on a collapse of a copper still at Phelps, N. Y. A somewhat similar case happened some two years since at an apple distillery. The owner, in filling his still, neglected to open a vent provided for the purpose at the top of the still; the result was a collapsed kettle.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Use of the Thermo Pile in the Determination of the Phrenological Character of the Cranium. By G. D.

On the Bursting of Cylindrical Boilers. By R. C.

On Sailing Faster than the Wind. By A.B.

On Quartz Mining in California. By G. P.

On Scientific Hanging. By J. D. H.

On the Power of Compound Levers. By R. D. W.

On the Computation of Logarithms. By G. W. McC.

On the Comet of 1866 and the November Meteors. By D. K.

On a Plan for Perpetual Motion. By J. L. C.

On a Recent Display of Zodiacal Light in Louisiana, and on the Flight of Birds, and on Boiler Strains. By J. B.

On the Intellectual Enjoyments of Science. By J. S.

On the Effect of Light on Combustion. By E. B.

On Boiler Strains. By J. C.

Also enquiries from the following:

W. & K.—T. C.—G. S.—R. F.—G. M. G.—H. D. S.—W. T. K.—W. N. G.—S. H. S.—S. L. B.—H. C. K.—H. L.—G. W. L.—E. H.—F. A. S.—J. A. S.—A. H.—T. S.—J. C. R.—W. D. G.—O. J. P.—H. L. M.—E. H. S.—W. A. M.—W. J.—H. B.—C. S. M.—J. P. D.—C. Z. M.—T. R. H.—J. C. J.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

March 18, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

24,446.—STRAW CUTTER.—R. Daniels. June 4.
21,456.—HEATING BUILDINGS BY STEAM.—S. F. Gold. June 4
24,484.—PAPER PULP.—J. B. Palser, G. Rowland. June 4.
24,495.—HARVESTER.—W. & T. Schnebly. June 4.
4,568.—RAILROAD CAR COUCH.—E. C. Knight. June 11.
4,571.—FINISHING BRUSHES.—T. Mitchell. June 11.

EXTENSIONS GRANTED.

23,291.—BALE BAND.—G. Brodie.
23,509.—ENVELOPE.—S. E. Pettee.

DESIGNS PATENTED.

6,493.—BELL.—O. F. Fogelstrand, Kensington, Conn.
6,498 to 6,504.—FLOOR CLOTHS.—C. T. & V. E. Meyer, Lyon's Farms, N. J.
6,506.—BEER MUG.—J. E. Miller, Pittsburgh, Pa.
6,507.—LOUNGE.—J. B. Rohrer, Philadelphia, Pa.
6,508.—BASKET.—S. I. Russell, Chicago, Ill.
6,509 to 6,511.—ORGAN CASES.—S. Hayward, Boston, Mass.

TRADE MARKS REGISTERED.

1,166 & 1,167.—TOBACCOS.—L. Bremer's Sons, Philadelphia.
1,168.—FILES.—Crocker Cutter Tooth File Co., Norwich, Conn.
1,169 & 1,170.—SIRUP.—Fairbanks & Gilman, New Orleans, La.
1,171.—COUGH BALSAM.—F. W. Kinsman, Augusta, Me.
1,172 & 1,173.—TOBACCO.—Robinson Manufacturing Co., Louisville, Ky.
1,174 & 1,175.—HOSE.—Boston Elastic Fabric Co., Mass.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should besecurely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row New York.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

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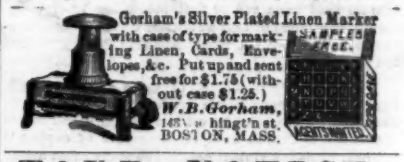

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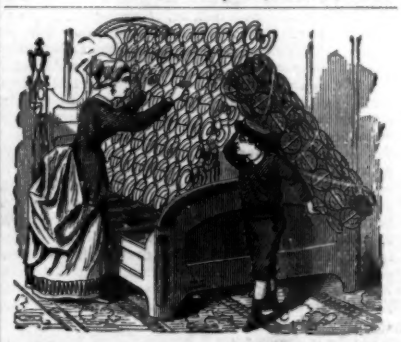

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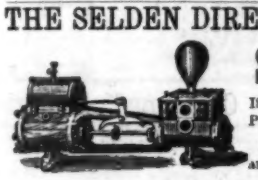
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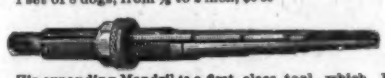

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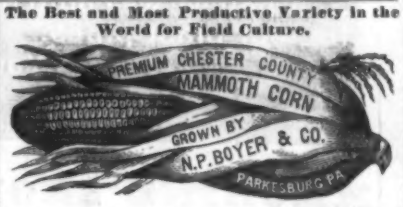

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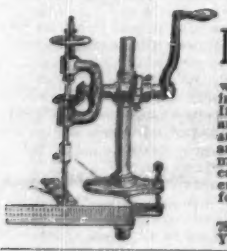

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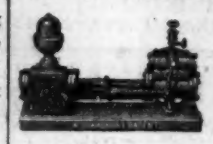

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